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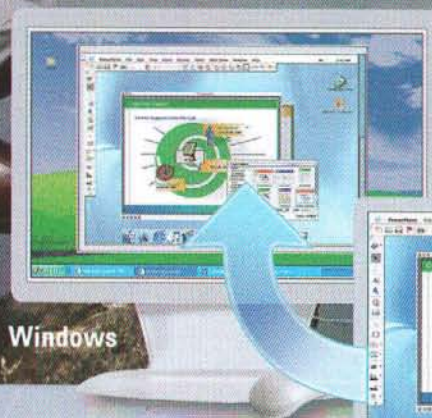
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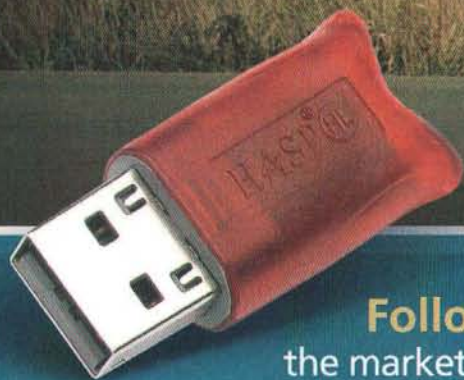
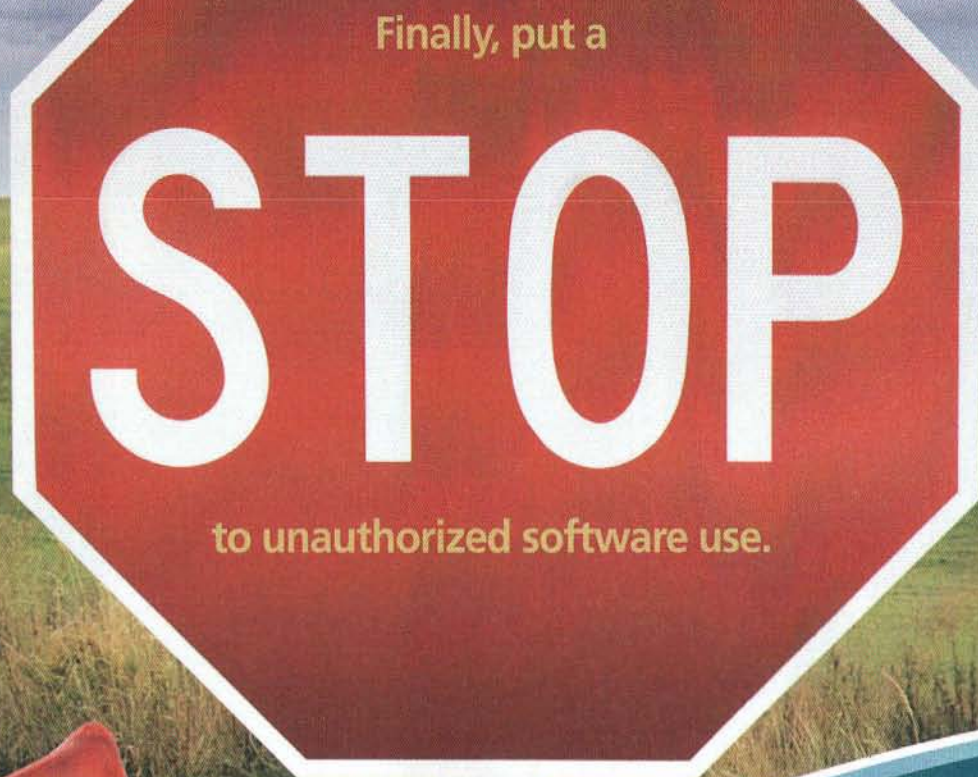


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From the Editor

Welcome to another month of Mac-centric technology! We're excited to be closing out 2006 with articles that truly showcase the elegance of OS X.

John Welch is back with a great tip on rolling out Microsoft Office updates to an office full of Macs. When you have a handful of Macs, updating each machine in turn isn't a problem – but when that number climbs, you need to automate. Let John show you how!

José Cruz brings an article that compliments John's: all about **Package Maker**. This article shows you everything you need to know about creating install packages for any use.

Another returning author, **Mihalis Tsoukalos** goes in depth writing a Dashboard Widget plug-in. While Widgets are very capable on their own, they are even more so when extended via Objective-C.

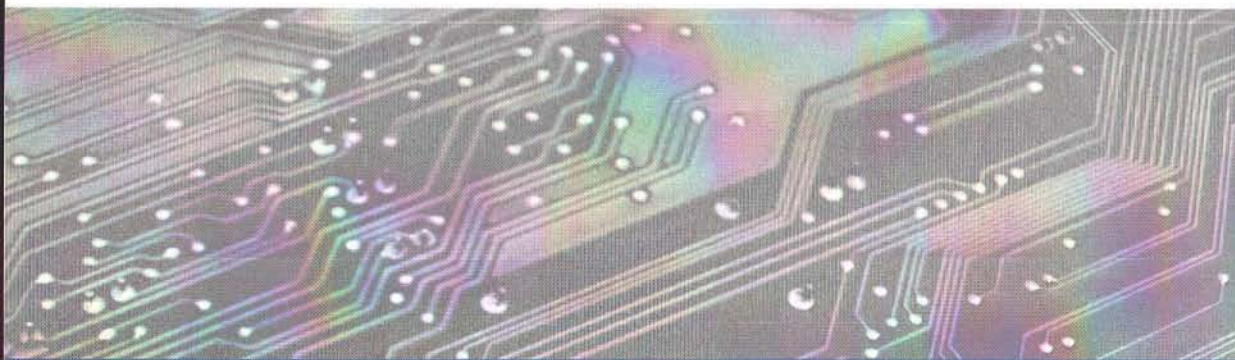
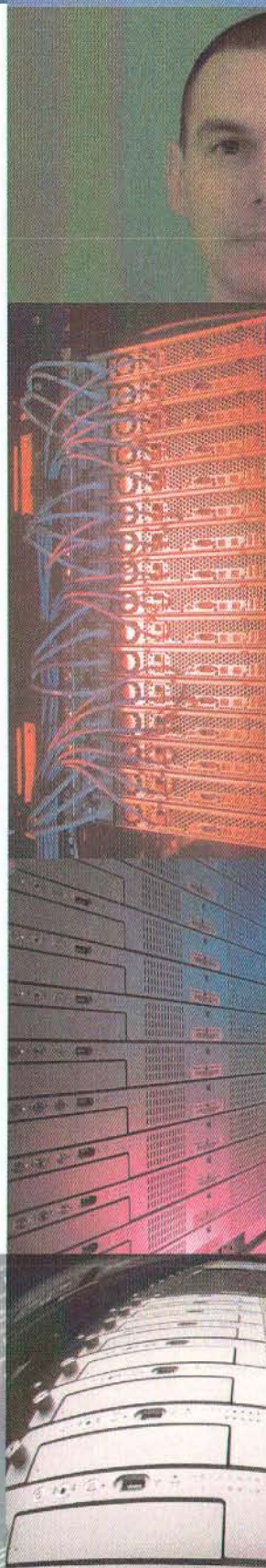
Author Paul Ammann again brings us two articles: a follow-up to his "**Intro to XSan**", plus something that goes right to the core of my heart: sorting using shell tools, primarily `awk` and `sort`.

Ben Waldie's **AppleScript Essentials** and my **Mac In The Shell** columns feature even more ways to get the most out of your Mac. But don't let that make anyone forget about our **product guide**! 'Tis the season to make purchases; for others, and yourself! This month's MacTech helps guide you to the best technology purchases available.

I hope everyone has made their plans for MacWorld. There's probably a little time left if you haven't. MacTech will have a booth once again, and many MacTech authors will be attending the show. We hope to see you there.

Happy holidays and Happy New Year! We hope to see you in person in January, and then will see everyone all of 2007 in print!

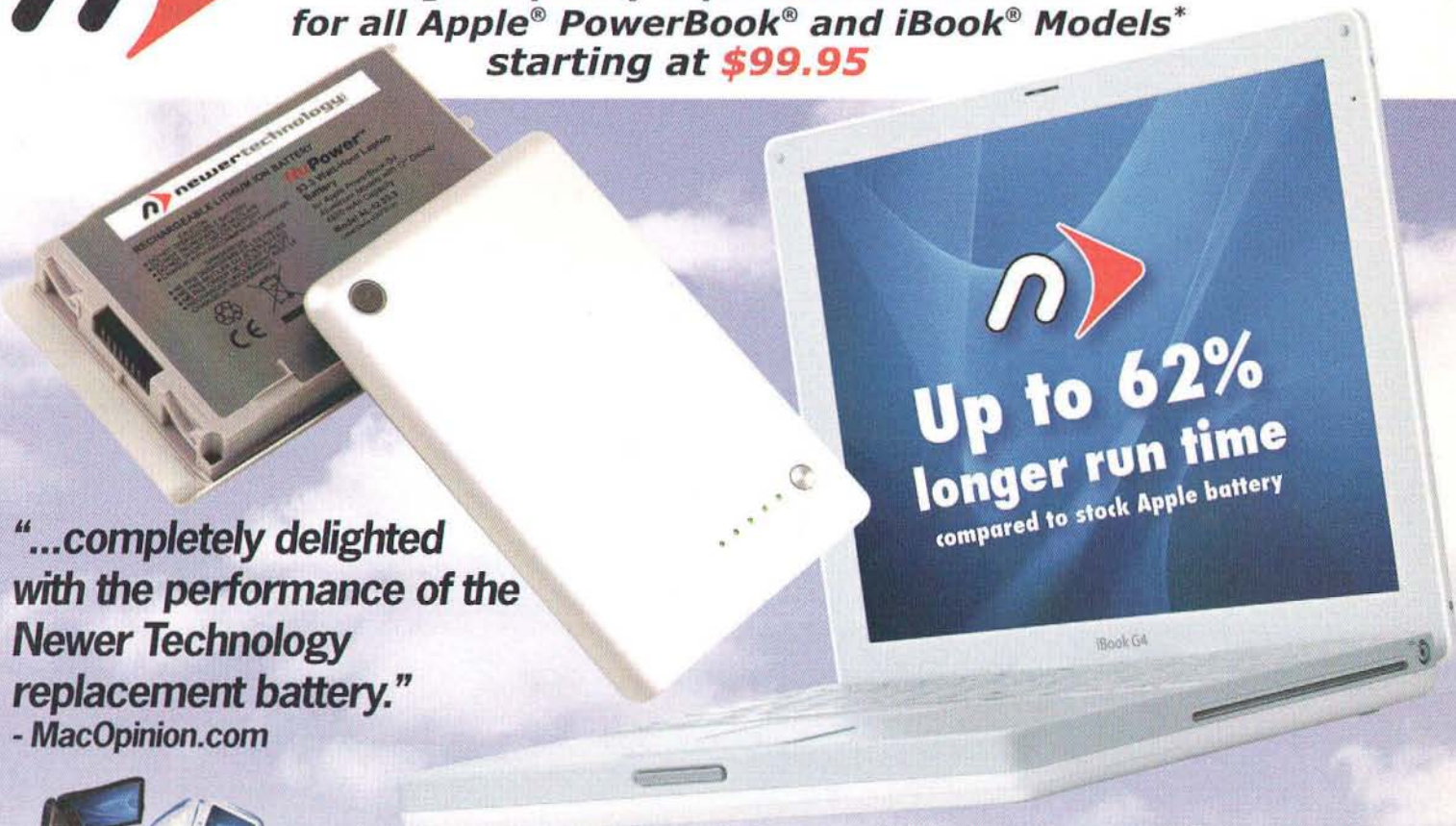
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APPLESCRIPT ESSENTIALS

by Benjamin S. Waldie

AppleScript Code Libraries

If you have been reading my columns for a while (prior to my introductory series on scripting different applications), then you may know that I am somewhat of a subroutine handler fanatic. I feel that handlers are an extremely important part of AppleScript development, and that every AppleScripter should be using them quite often. Unfortunately, many AppleScript developers do not.

There are many benefits to using handlers in a script. Let's discuss a few of these briefly. Handlers provide a mechanism for modularizing AppleScript code into generic *chunks*, which can be called from multiple locations within a script. This can lead to more efficient script writing. Instead of spending time writing virtually the same code over and over again throughout a script, you can instead focus more time on writing a solid and reliable handler, which can be called numerous times throughout the script. Not only does this help to cut down on the total amount of code you need to write in a script, but it also helps to provide a more focused completed script. Because multiple sections of the script call the same handler code, there are typically fewer areas to troubleshoot if problems do occur during execution. Furthermore, if written modularly enough, it may even be possible to extract a handler from a script, and plug it into other scripts, potentially reducing script writing time in the future too. This leads me into the main focus of this month's column, AppleScript code libraries.

What is an AppleScript Code Library

What exactly is an AppleScript code library? An AppleScript code library, aka a script library, is an AppleScript file that contains pieces of code, usually handlers, which may be loaded and accessed by another script during its execution. AppleScript code libraries provide an excellent way to organize generic chunks of code, to be called by one or more scripts.

For example, suppose you often write scripts that automate tasks in QuarkXPress. The odds are probably pretty good that many of these scripts will perform similar tasks, and many may use similar or identical code. If this were the case, it would make sense to write much of your Quark code as generic handlers, which can then be merged together into a single script file to form a script library. This

library of Quark handlers could then be saved into a central location, and then loaded by other scripts in the future, which can then call its handlers as needed.

Building a Script Library

Building a script library is really as straightforward as creating any AppleScript file. There aren't really any hardcore requirements. A script library will often contain handlers, but it doesn't need to. It can contain anything that any other script can contain, including properties, globals, a run handler, etc. A script library can even load other script libraries.

Preparing to Follow Along

The example code that we will explore throughout this month's column will involve calling code within a script library file. To follow along with these examples, you'll need to create a script library file. Begin by creating a new Script Editor document, and entering the following code.

```
property someProperty : "Property Value"

display dialog "Running..."

on someHandler()
    display dialog "Handler executing..."
end someHandler

on displayProperty()
    display dialog someProperty
end displayProperty
```

As you can see, this code that will make up our script library contains a property, some run handler code, and some subroutine handlers. We will walk through the process of accessing each of these elements in our script library from within another script.

Next, we need to save our script library. To do this, just save the Script Editor document as a compiled script to your desktop, and name it *My Library.spt*.

Loading a Script Library

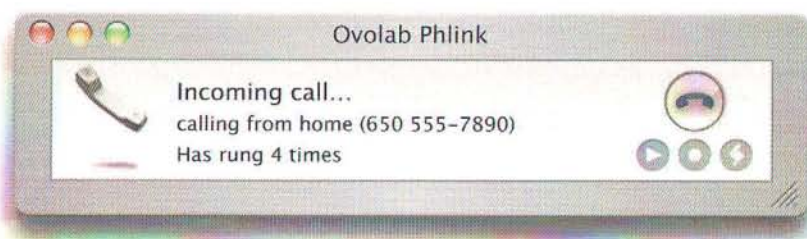
Now that we have created our script library, we are ready to begin accessing it from another script. To do this, we will make use of a command that is included in the *Scripting Commands* suite of the Standard Additions scripting addition, called `load script`. The `load script` command accepts one direct parameter, a reference to a script file to be loaded. For example:

```
set theLibraryPath to alias ((path to desktop folder as string) & "My Library.spt")
load script theLibraryPath
-> «script»
```

If you run the above example code, you will find that, in Script Editor's result pane, the result of the `load script` command is a reference to the newly loaded script library. Like any other result, this reference may be placed into a variable, for later reference throughout your script. For example:

```
set theLoadedScript to load script theLibraryPath
```


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Types of Scripts that May Be Loaded

Momentarily, we will explore what you can do once you have loaded a script library file. However, I first want to mention the types of script library files that may be loaded. The `load script` command may be used to load compiled script files, script applications, script bundles, and script application bundles. It may not be used to load scripts that have been saved in text format. Also, if you are using an older version of Mac OS X (pre-10.3.x), then you will not be able to load script bundles or script application bundles. The ability to load these types of scripts was not possible prior to AppleScript version 1.9.2 in Mac OS X 10.3.

Running a Script Library

So, now that we have loaded a script library file, what do we do with it? One thing that we can do with it is run it. This can be done by simply telling the loaded script to run. For example:

```
set theLibraryPath to alias ((path to desktop folder as
string) & "My Library.scpt")
set theLoadedScript to load script theLibraryPath
tell theLoadedScript to run
-> {button returned:"OK"}
```

If you test this example code, then you will find that telling the loaded script to run will result in the execution of any code located within the loaded script's run handler. See figure 1.

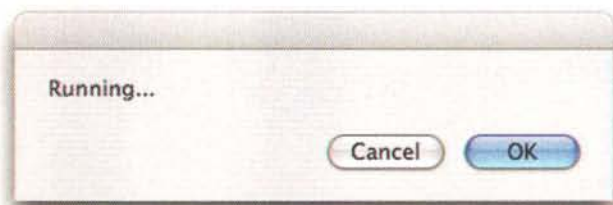


Figure 1. Running a Loaded Script Library

You will also find that, if the `run` handler of the loaded script produces a result, then that result will be passed back to the loading script as the result of the `run` command.

There are actually several syntactical variations to running a loaded script. Another way is to use the `run` command, followed by a reference to the loaded script as a direct parameter. For example:

```
run theLoadedScript
```

Yet another way to run a loaded script is to make use of the `run script` command, which is also found in the *Scripting Commands* suite in the Standard Additions scripting addition. This command is also followed by a reference to the loaded script as its direct parameter.

```
run script theLoadedScript
```

When using the `run script` command, it's also not actually necessary to load the script prior to running it. The `run script` command itself may be passed the path to a script file as its direct parameter. This will cause the script file to be loaded and run, all in one shot, as demonstrated here:

```
run script theLibraryPath
```

Calling Handlers within a Script Library

While running a loaded script is great, and can sometimes be very useful, the real power comes with the ability to trigger handlers within loaded script libraries. Once a script has been loaded, any of its handlers are at your disposal, and may be called as needed, throughout the loading script.

Handlers in a loaded script are called much in the same way that local handlers are called within a script. Unlike local handlers, however, they must just be directed to the loaded script. Often, this is done through the use of a simple `tell` statement. In other words, the loading script tells the loaded script to execute a specific handler. For example:

```
set theLibraryPath to alias ((path to desktop folder as
string) & "My Library.scpt")
set theLoadedScript to load script theLibraryPath
tell theLoadedScript to someHandler()
-> {button returned:"OK"}
```

If you run the previous example code, you will find that the `someHandler()` handler within the loaded script is executed, as indicated by the dialog the handler displays. See figure 2.

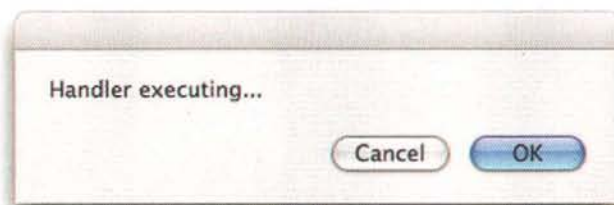


Figure 2. Calling a Handler in a Loaded Script Library

As an alternative to using a `tell` statement to call a handler within a loaded script, another equally acceptable method is the following, which will perform in exactly the same manner as the previous example.

```
someHandler() of theLoadedScript
```

Accessing Properties within a Script Library

Referencing Properties in a Script Library

As one might expect, if a loaded script contains properties, then those properties may be accessed by any code, such as handlers, within the loaded script. For example, here is some example code that will execute a handler within our loaded script. This handler will display the value of a property in the loaded script. See figure 3.

```
set theLibraryPath to alias ((path to desktop folder as
string) & "My Library.scpt")
set theLoadedScript to load script theLibraryPath
tell theLoadedScript to displayProperty()
```


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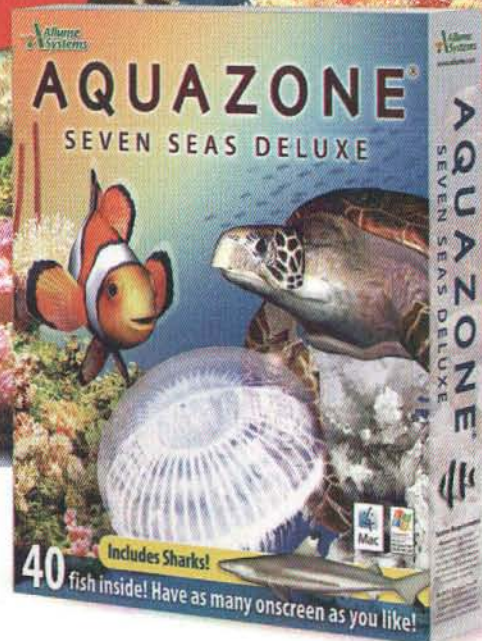


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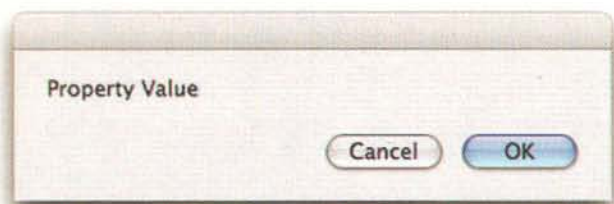


Figure 3. Calling a Handler in a Loaded Script, to Display a Property Value

Properties within a loaded script may also be accessed by the loading script. This is done similarly to the process of calling handlers in a loaded script from within the loading script. For example:

```
set theLibraryPath to alias ((path to desktop folder as
string) & "My Library.scpt")
set theLoadedScript to load script theLibraryPath
someProperty of theLoadedScript
-> "Property Value"
```

Modifying Properties in a Script Library

As you may know, when utilized in a script application, properties are persistent between executions of the script. In other words, if you modify the value of a property within a script application, then the modified property value will be retained until the property is modified again, or until the script is recompiled. Upon a recompile, the property will revert to its original value.

Properties in loaded scripts are handled slightly differently. If you modify a property in a loaded script, the modified property value will be retained as long as the script remains loaded. However, the next time the script is loaded, it will revert back to its original value. The modified property value is not retained between loads. This can be demonstrated via the following example code.

```
set theLibraryPath to alias ((path to desktop folder as
string) & "My Library.scpt")
set theLoadedScript to load script theLibraryPath
tell theLoadedScript to displayProperty()
set someProperty of theLoadedScript to "New Property Value"
tell theLoadedScript to displayProperty()
```

If you run the example code above, you will find that the `displayProperty()` handler will be called twice. Once, immediately after the script has been loaded, and again, after the value of the property `someProperty` has been modified to a new value. The first time the `displayProperty()` handler is called, it will display a dialog indicating the property's original value, shown previously in figure 3. The second time the handler is called, it will display a dialog indicating the property's new value, showing that the property's value has actually been changed. See figure 4.

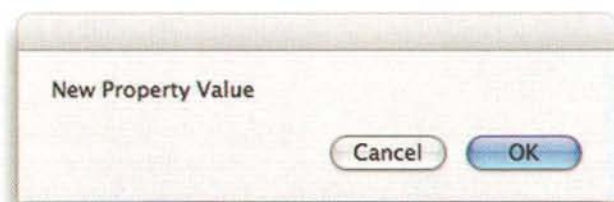


Figure 4. Calling a Handler in a Loaded Script, to Display a Modified Property Value

Now, to demonstrate that the modified property value is not retained between loads, try running the previous example code a second time. When you do this, you will find that the first time the `displayProperty()` handler is called, it displays the original unmodified value for property `someProperty`.

Storing a Modified Script Library

However, it is actually possible to retain a modified property value within a loaded script. To do this, the loaded script must be stored back into itself after the property has been modified. This is done using the `store script` command, which is found in the *Scripting Commands* suite in the Standard Additions scripting addition. For example:

```
set theLibraryPath to alias ((path to desktop folder as
string) & "My Library.scpt")
set theLoadedScript to load script theLibraryPath
tell theLoadedScript to displayProperty()
set someProperty of theLoadedScript to "New Property Value"
store script theLoadedScript
```

In the example code above, notice that, while we have specified the loaded script to be stored, we have not specified *where* it should be stored. When the `store script` command is used with only a direct parameter, the script to be stored, you will be prompted to specify where the loaded script is to be stored. See figure 5.

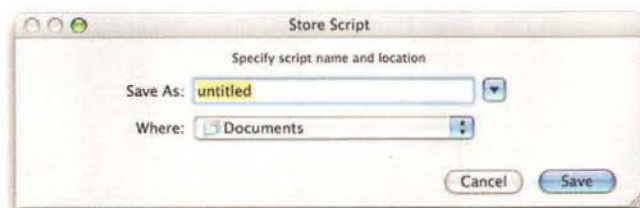


Figure 5. Storing a Script Using a Specified Name and Location

To store the script back to its original file path, we can specify a file path for the `store script` command's optional `in` labeled parameter. For example:

```
store script theLoadedScript in theLibraryPath
```

When used in this manner to store a script back to its original path, the `store script` command will attempt to overwrite the existing script file. Because of this, another dialog will be displayed, asking whether the existing file should be replaced. See figure 6.

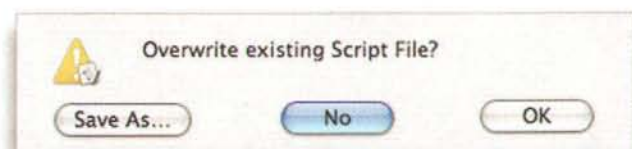


Figure 6. Storing a Script With or Without Replacing an Existing Script

To allow the loaded script to be stored back to its original path without displaying this dialog, we can

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make use of another optional labeled parameter for the `store script` command, replacing. For example:

```
store script theLoadedScript in theLibraryPath with  
replacing
```

Running this example code will now result in our loaded script being stored back to its original path, with no dialog being displayed. If you now load the script again and call the `displayProperty()` handler, you will find that the new property value has been retained. The modified property value will continue to be retained until it is modified again, or until the script library file is opened and recompiled.

In Closing

Hopefully, you're starting to see the benefits of using script libraries, especially for sharing subroutine handlers among multiple scripts. The example code throughout this column should provide you with a good foundation for starting to create and access your own libraries. Once you feel comfortable using the techniques that we have discussed, you may want to consider exploring some other interesting ways of utilizing script libraries.

Try saving a script library as a stay opened application and pre-launching it to reduce loading time. Then, allow multiple scripts to call the code

within the running script library. Also, we've discussed accessing properties in loaded scripts. For extra credit, try also exploring how globals work in loaded libraries. Can globals be shared between the loading script and the loaded script? Perform some tests on your own to find out.

Until next time, keep scripting!

MI

About The Author



Ben Waldie is the author of the best selling books "AppleScripting the Finder" and the "Mac OS X Technology Guide to Automator", available from <http://www.spiderworks.com>, as well as an AppleScript Training CD, available from <http://www.vtc.com>. Ben is also president of Automated Workflows, LLC, a company specializing in AppleScript and workflow automation consulting. For years, Ben has developed professional AppleScript-based solutions for businesses including Adobe, Apple, NASA, PC World, and TV Guide. For more information about Ben, please visit <http://www.automatedworkflows.com>, or email Ben at ben@automatedworkflows.com.

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Creating a Dashboard Widget that uses a plugin.

What are Widget plugins and how to use them from within a Dashboard Widget

By Mihalios Tsoukalos

Introduction

In this article, you will learn how to create Widget plugins by using the Objective-C programming language. In fact, this article will help you create the *MyPlugin* Widget plugin that is included in a Dashboard Widget. What the plugin does is to send the "Hello World!" message to the Widget that finally prints it out. Although this is a simplistic Widget, the presented methods, procedures, and practices remain unchanged when you want to create a more sophisticated Widget plugin.

Objective-C was introduced with NeXTSTEP and OPENSTEP. It is mainly used in combination with the Cocoa framework (a collection of libraries) under Mac OS X, although you can program in Objective-C without using these libraries if you want to. Widget plugins are created using Objective-C.

What is a Widget Plugin?

Let us face the truth now: Widgets alone cannot access applications directly, receive distributed notifications, or read files from disk without the help of the `widget.system()` call which is not always the preferred solution. To enable these interactions, you need to provide a plugin. You are required to implement an interface for your plugin that makes itself available to the Widget.

Advantages and Disadvantages of Widget Plugins

The advantages of plugins include the following:

1. Your source code is hidden and more secure.
2. Nobody can change your Widget plugin without your permission.
3. You can create commercial Widgets.

4. You can do things that simply are not possible with JavaScript and the built-in Widget functions by using the Cocoa framework.

Their disadvantages are the following:

1. It is more difficult and time consuming to program a plugin for a functionality that is also supported by JavaScript.
2. It is more difficult to debug a Widget plugin.
3. You have to learn Objective-C.
4. You also have to learn Cocoa.

Which files compose the complete MyPlugin Widget?

The files that compose the MyPlugin Widget presented in this article are the following:

1. Info.plist: the well-known file necessary for every Widget that has an uncommon key added.
2. MyPlugin.html: the main HTML file for the "MyPlugin" Widget.
3. MyPlugin.js: the JavaScript code needed for the "MyPlugin" Widget.
4. MyPlugin.m: the MyPlugin.m file contains the Objective-C code.
5. MyPlugin.h: the MyPlugin.h file is the Objective-C header file for MyPlugin.m.
6. Directory MyPlugin.widgetplugin: this contains the files for the Widget plugin that are automatically created by Xcode. After you successfully build your Xcode project, you will find it inside the *build/release* directory of your project's directory.
7. Two image files called Default.png and Icon.png. Every Dashboard Widget has those two graphics files. The Icon.png file should be 82x82 pixels, and is displayed in the Dashboard Widget Bar.

The Info.plist file

The contents of the Info.plist file are the following:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple Computer//DTD PLIST 1.0//EN"
"http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
  <key>CFBundleDisplayName</key>
  <string>MyPlugin</string>
  <key>CFBundleIdentifier</key>
  <string>com.mactech.widget.myplugin</string>
  <key>CFBundleName</key>
  <string>My Widget Plugin</string>
  <key>CFBundleShortVersionString</key>
  <string>1.1</string>
  <key>CFBundleVersion</key>
  <string>1.1</string>
  <key>CloseBoxInsetX</key>
  <integer>45</integer>
  <key>CloseBoxInsetY</key>
  <integer>35</integer>
  <key>MainHTML</key>
  <string>MyPlugin.html</string>
  <key>Plugin</key>
  <string>MyPlugin.widgetplugin</string>
</dict>
</plist>
```

The unusual key that I talked about previously is the *Plugin* key. Its value is the name of the directory that holds the Widget plugin files.

The MyPlugin.html file

The contents of the MyPlugin.html file are the following:

```
<!--
File: MyPlugin.html
Programmer: Mihalis Tsoukalos
Date: Saturday 16 September 2006
-->
<html>
<head>
  <!-- The CSS file for this widget -->
  <!-- This is a very simple CSS file -->
  <style type="text/css">
    @import "MyPlugin.css";
  </style>

  <!-- The JavaScript file for the "MyPlugin" Widget -->
  <!-- An essential file for implementing the plugin
  functionality -->
  <script type="text/javascript" src="MyPlugin.js"
  charset="utf-8"/>

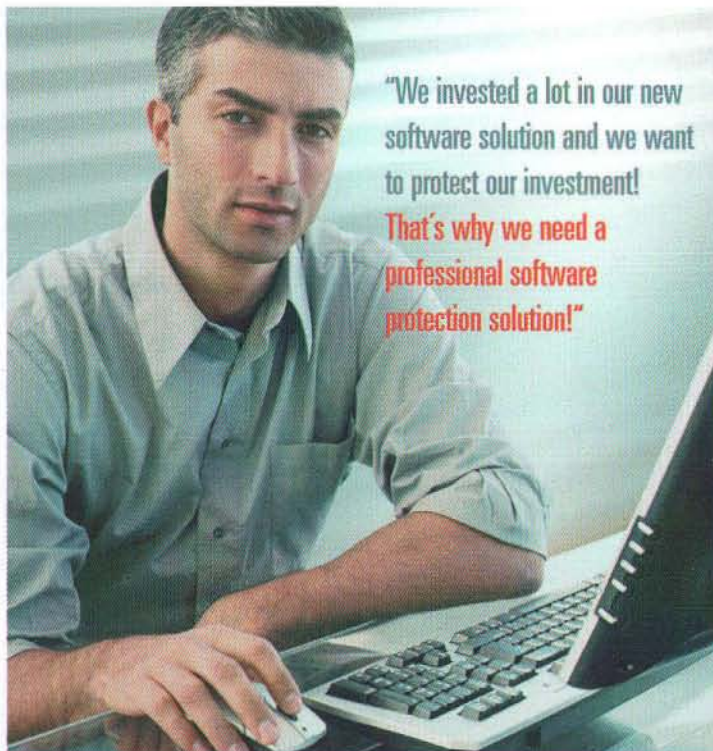
</head>

<!-- Every time the user clicks anywhere on the "MyPlugin"
Widget,
run the next() JavaScript function -->
<body onclick="next()">

  
  <!-- Basic placeholder text -->
  <div id="quote">Click here to say hello!</div>

</body>
</html>
```

It should be noted that the MyPlugin.html file acts as the glue that connects all the other Widget files.



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The MyPlugin.css File

The contents of the MyPlugin.css file are the following:

```
/*
File: MyPlugin.css
Programmer: Mihalis Tsoukalos
Date: Saturday 16 September 2006

*/

body
{
    margin: 0;

#quote
{
    font: 35px "Times" ;
    font-weight: bold;
    color: gray;
    text-shadow: white 0px 1px 0px;
    position: absolute;
    top: 100px;
    left: 45px;
    width: 165px;
    opacity: 1.0;
}
```

The MyPlugin.js File

The MyPlugin.js file is the most important file of the whole Widget. A small mistake in it and the Widget will either misbehave or not work at all. Its contents are the following:

```
/*
File: MyPlugin.js
Programmer: Mihalis Tsoukalos
Date: Saturday 16 September 2006

*/

//This code is part of the
// "MyPlugin" Dashboard Widget.

// Increases the current value by one.
// It uses the Objective-C Widget
// plugin to get the new value.

function swap()
{
    if (MyPlugin)
    {
        // get the next text from the Widget plugin
        var line = MyPlugin.getText();
        // drop in the new text
        document.getElementById("quote").innerHTML = line;
    }
    else
    {
        alert("Widget plugin not loaded.");
    }
}

// Performs the transition from the current
// text to the next one using a simple effect.
// Note: In this example both texts are the same.
function next()
{
    // fades out the current text
    hideContent();
    // swaps in the next text
    setTimeout("swap();",500);
}
```

```
// fades in the new text
setTimeout("showContent();",550);
}

//*****
// Animation code
// Handles the fades in and out
//*****

var animation = {duration:0, starttime:0, to:1.0, now:1.0,
    from:0.0, firstElement:null, timer:null};

function showContent()
{
    // reset the animation timer value, in case a value was left behind
    if (animation.timer != null)
    {
        clearInterval (animation.timer);
        animation.timer = null;
    }
    // set it back one frame
    var starttime = (new Date).getTime() - 13;
    // animation time, in ms
    animation.duration = 500;
    // specify the start time
    animation.starttime = starttime;
    // specify the element to fade
    animation.firstElement = document.getElementById
('quote');
    // set the animation function
    animation.timer = setInterval ("animate();", 13);
    animation.from = animation.now;
    // beginning opacity (not ness. 0)
    // final opacity
    animation.to = 1.0;
    // begin animation
    animate();
}

function hideContent()
{
    if (animation.timer != null)
    {
        clearInterval (animation.timer);
        animation.timer = null;
    }
    var starttime = (new Date).getTime() - 13;
    animation.duration = 500;
    animation.starttime = starttime;
    animation.firstElement = document.getElementById
('quote');
    animation.timer = setInterval ("animate();", 13);
    animation.from = animation.now;
    animation.to = 0.0;
    animate();
}

function animate()
{
    var T;
    var ease;
    var time = (new Date).getTime();

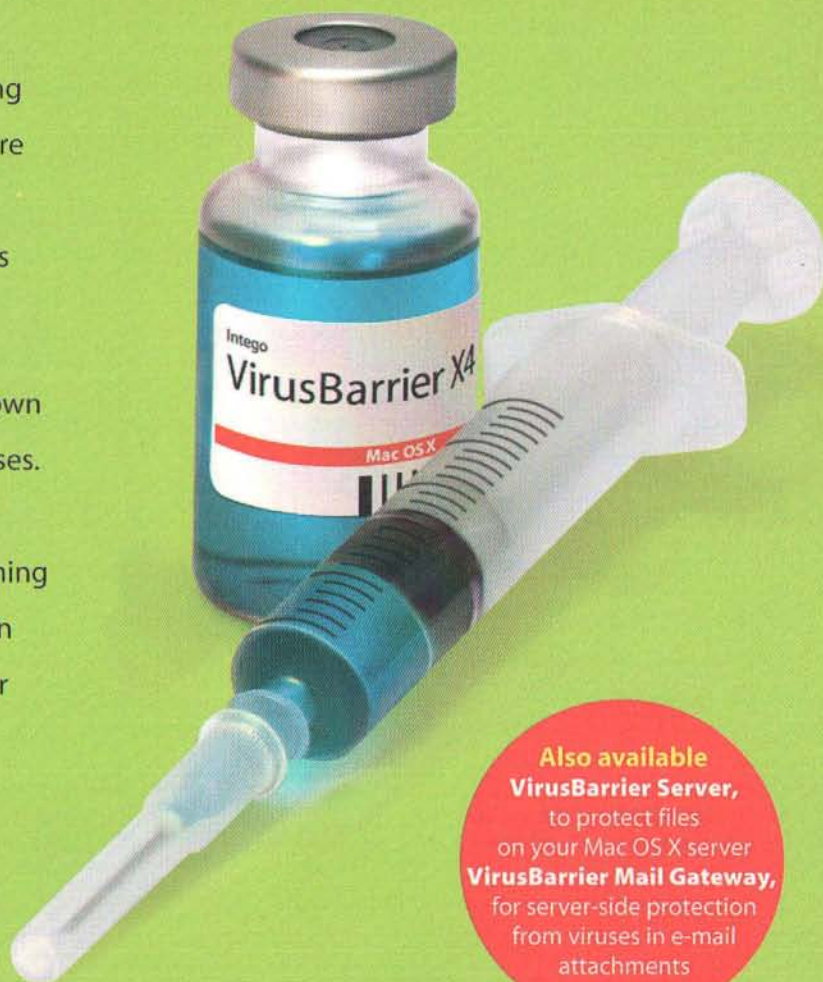
    T = limit_3(time-animation.starttime, 0,
animation.duration);

    if (T >= animation.duration)
```

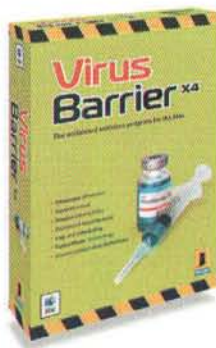

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```

    clearInterval (animation.timer);
    animation.timer = null;
    animation.now = animation.to;
  }
  else
  {
    ease = 0.5 - (0.5 * Math.cos(Math.PI * T /
animation.duration));
    animation.now = computeNextFloat (animation.from,
animation.to, ease);
  }

  animation.firstElement.style.opacity = animation.now;
}

// these functions are utilities used by animate()
function limit_3 (a, b, c)
{
  return a < b ? b : (a > c ? c : a);
}

function computeNextFloat (from, to, ease)
{
  return from + (to - from) * ease;
}

```

The `swap()` JavaScript function is the single most important function of the `MyPlugin.js` file. It first checks if the `MyPlugin` Widget plugin is available. If it is available, it calls the `MyPlugin.getText()` function and gets its output. It then prints the results using the `document.getElementById("quote").innerHTML` JavaScript command.

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Creating the Widget plugin using Xcode

A widget plugin is a *Cocoa bundle*. Start in Xcode, by using the "Cocoa Bundle" template. In the plugin code, implement the widget plugin interface. Build your Objective-C code, and you are ready to use your Widget plugin. Before you create the actual Widget plugin, you must first learn how to create Universal binaries in Xcode. Apple correctly suggests that you only create Widgets with Universal binary plugins.

Creating Universal Binaries

To make Widget plugins able to work on both PowerPC and Intel Macs, you have to create them as so-called Universal Binaries. This is easily accomplished, when using the latest Version of Xcode and all necessary steps are described here.

The steps for creating a command line Universal binary are as follows:

1. First you have to open Xcode from `/Developer/Applications` directory.
2. Choose File ⌘ New Project.
3. Select the Standard Tool option from the Command Line Utility project list (see Figure 1), click Next, and give it a name (I used *bw*).

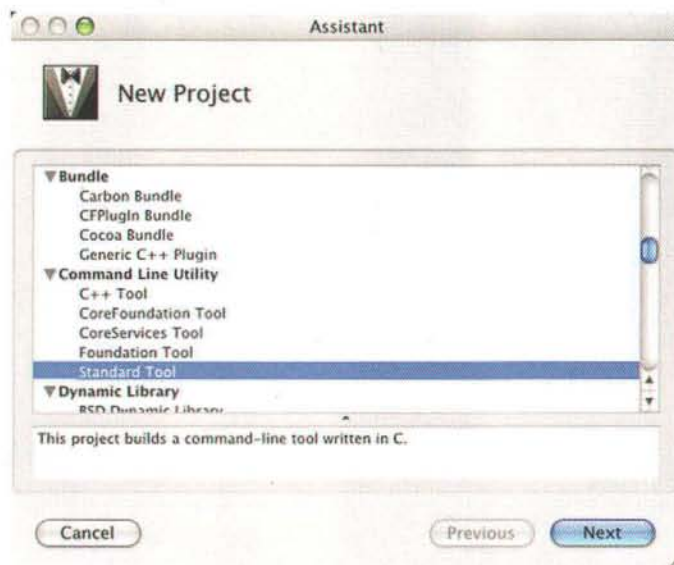


Figure 1. Creating a new project in Xcode 2.4

4. What is automatically created by Xcode is the famous "Hello World!" C program. This means that you do not have to write any code! You can see the code by double clicking on *main.c* file with your mouse.
5. You now have to choose Project ⌘ Edit Project Settings. You will now see something similar to Figure 2. Please make sure that the Mac OS X 10.4 (Universal) option is selected!



Figure 2. Editing project settings

6. Now you have to go to the "Build" tab and select the "Architectures" line. Choose "Edit" and you will see Figure 3.



Figure 3. Selecting build architectures

7. You are almost done. Check both architectures and Build your project. You now have a universal binary inside the directory of your project!

The results of the above process using the "Hello World!" program (the pure C version from the *hw* project) we created as an example, can be seen in the following lines:

```
big:~ mtsouk$ file hw
hw: Mach-O fat file with 2 architectures
hw (for architecture ppc): Mach-O executable ppc
hw (for architecture i386): Mach-O executable i386
```

Creating and Compiling the Objective-C code for the Widget plugin

A Widget plugin is a *Cocoa bundle*. Start in Xcode, and select the "Cocoa Bundle" template. In the plugin code, you must implement the Widget plugin interface. Build your Objective-C code, and you are ready to use your Widget plugin. Let us now be more analytical.



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The required steps for creating a Cocoa bundle, which is our Widget plugin, are as follows:

1. First you have to open Xcode from /Developer/Applications directory.
2. Go to File menu  New Project and then create a new "Cocoa Bundle" from the list of templates. You should now give the project a name (you **must** give *MyPlugin* as the project name in this case). You will then see the window shown in Figure 4.

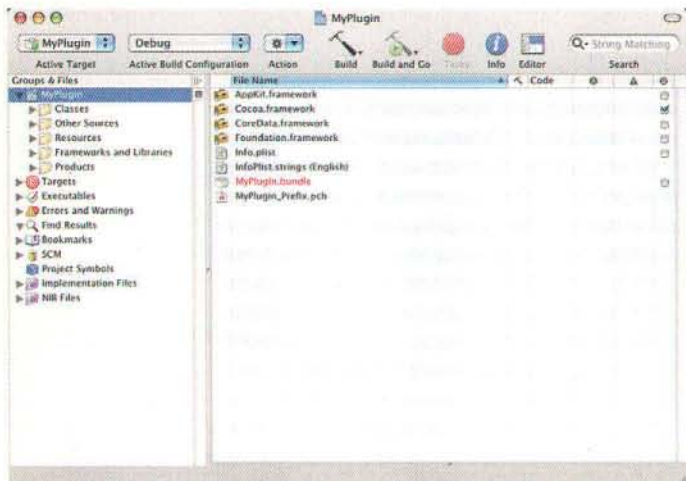



Figure 4. Creating a Cocoa Bundle for your Widget plugin

3. As this new bundle does not have a base class, you have to create one by right clicking on the "Classes" folder and then selecting Add  "New File..." from the menu.
4. You will now see the "Assistant" window of Figure 5. Select "Objective-C class" from the Cocoa group and click "Next".

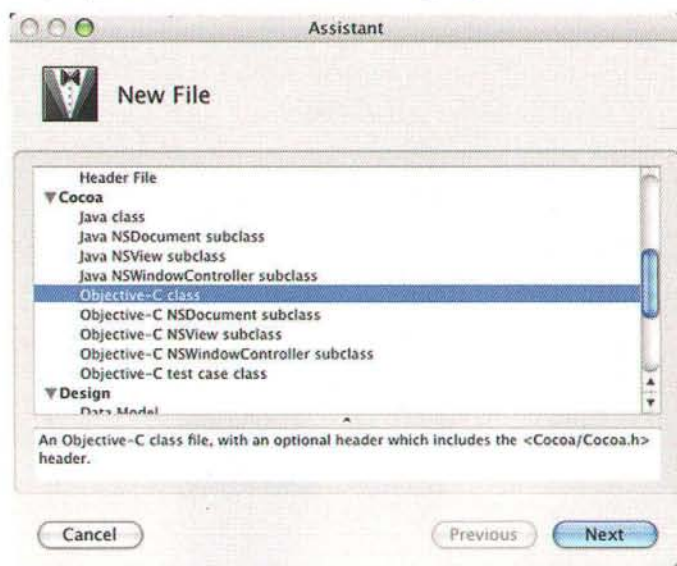


Figure 5. Adding an Objective-C class to our project

5. The "Assistant" window will now look as in Figure 6. The filename I gave to the new file is *MyPlugin.m*, and I also checked the "Also create *MyPlugin.h*" checkbox. You now have to press the "Finish" button and you are done.

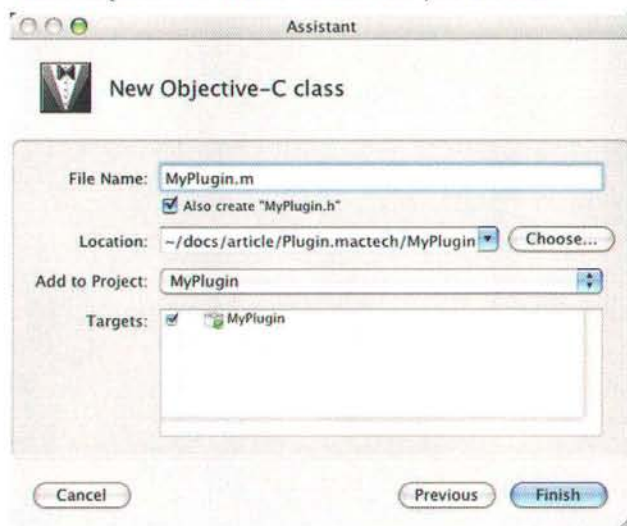







Figure 6.

6. The only thing that is now missing is to write the actual Objective-C code and arrange the last few details. You also have to compile your files. Do not forget to follow the guidelines on how to create a Universal binary executable.

Now that you have created the basic infrastructure for your Cocoa bundle, you should arrange the last details.




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1. Find the Info.plist file from the Resources group.
2. Set the "CFBundleIdentifier" key to "com.mactech.widget.myplugin".
3. Set the "NSPrincipalClass" key to "MyPlugin".
4. You should now make a change at the "Wrapper Extension" setting in the "Targets" group of parameters. If you right click on the "MyPlugin" item and choose "get info", you will get an image similar to Figure 7. If you click on the "Build" tab and scroll down until you find the "Wrapper Extension" setting, you will be able to change its value by double clicking on the value-tab. The new value should be "widgetplugin".

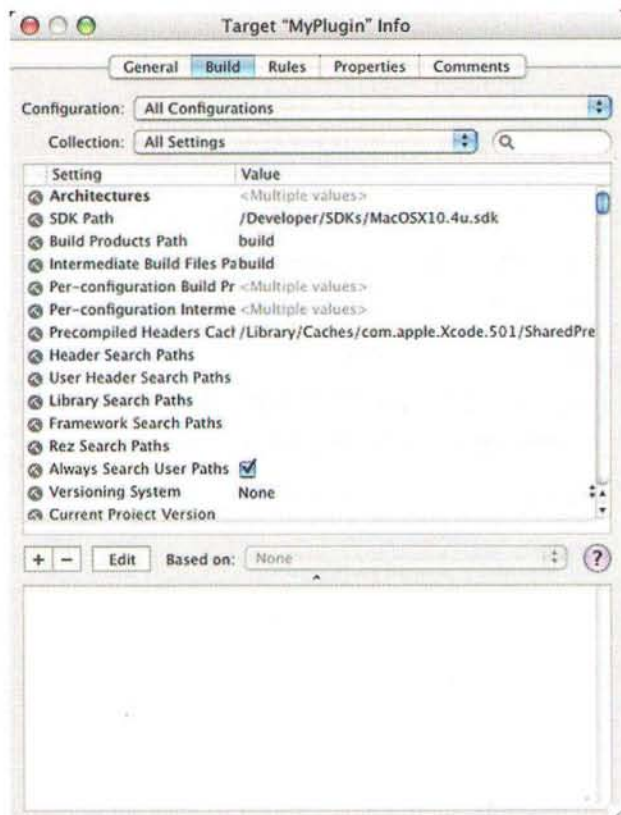


Figure 7. Get Info from Targets group of parameters

The Info.plist file for the Xcode project

The contents of the Info.plist file for the Xcode project (which is different from the Info.plist file that resides inside the root directory of the Widget) should now be as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple Computer//DTD PLIST 1.0/EN"
"http://www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
  <key>CFBundleDevelopmentRegion</key>
  <string>English</string>
  <key>CFBundleExecutable</key>
  <string>$(EXECUTABLE_NAME)</string>
  <key>CFBundleName</key>
  <string>$(PRODUCT_NAME)</string>
  <key>CFBundleIconFile</key>
  <string></string>
```

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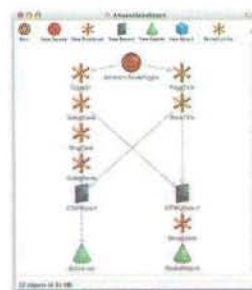
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```

<key>CFBundleIdentifier</key>
<string>com.mactech.widget.myplugin</string>
<key>CFBundleInfoDictionaryVersion</key>
<string>6.0</string>
<key>CFBundlePackageType</key>
<string>BNDL</string>
<key>CFBundleSignature</key>
<string>Mtsouk</string>
<key>CFBundleVersion</key>
<string>1.0</string>
<key>NSPrincipalClass</key>
<string>MyPlugin</string>
</dict>
</plist>

```

The MyPlugin.h file contents

You should now change the contents of the MyPlugin.h file to look as follows:

```

/*
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NOTE: Use of this source code is subject to the terms of
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*/

#import <Cocoa/Cocoa.h>
#import <WebKit/WebKit.h>

@interface MyPlugin : NSObject
{
    NSString* s;
}

@end

```

The MyPlugin.m file contents

Last, you should change the contents of the MyPlugin.m file to look as follows:

```

//
// MyPlugin.m
// MyPlugin
//
// Created by Mihalis Tsoukalos on 16/09/2006.
// Copyright 2006 __MyCompanyName__. All rights reserved.
//

#import "MyPlugin.h"

NSString* s = @"";

@implementation MyPlugin

/*****
// Methods required by the WidgetPlugin protocol
*****/

// initWithWebView

```

```

//
// This method is called when the widget plugin is first
loaded as the
// widget's web view is first initialized
-(id)initWithWebView:(WebView*)w
{
    //NSLog(@"Entering initWithWebView:%@", w);
    self = [super init];
    srand(time(NULL));
    return self;
}

-(void)dealloc
{
    [super dealloc];
}

/*****
// Methods required by the WebScripting protocol
*****/

// windowScriptObjectAvailable
//
// This method gives you the object that you use to bridge between the
// Obj-C world and the JavaScript world. Use setValue:forKey: to give
// the object the name it's referred to in the JavaScript side.
-(void>windowScriptObjectAvailable:(WebScriptObject*)wso
{
    //NSLog(@"windowScriptObjectAvailable");
    [wso setValue:self forKey:@"MyPlugin"];
}

// webScriptNameForSelector
//
// This method lets you offer friendly names for methods that normally
// get mangled when bridged into JavaScript.
+(NSString*)webScriptNameForSelector:(SEL)aSel
{
    NSString *retval = nil;

    //NSLog(@"webScriptNameForSelector");
    if (aSel == @selector(getText)) {
        retval = @"getText";
    } else if (aSel == @selector(logMessage:)) {
        retval = @"logMessage";
    } else {
        NSLog(@"\tunknown selector");
    }

    return retval;
}

// isSelectorExcludedFromWebScript
//
// This method lets you filter which methods in your plugin are
// accessible to the JavaScript side.
+(BOOL)isSelectorExcludedFromWebScript:(SEL)aSel {
    if (aSel == @selector(getText) || aSel ==
@selector(logMessage:)) {
        return NO;
    }
    return YES;
}

// isKeyExcludedFromWebScript
//
// Prevents direct key access from JavaScript.
+(BOOL)isKeyExcludedFromWebScript:(const char*)k {
    return YES;
}

/*****
// The actual methods used in this plugin, to be called by JavaScript and
// identified in isSelectorExcludedFromWebScript.
*****/

// getText

```


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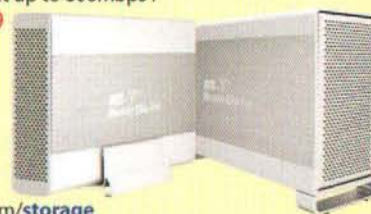


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```
//
// Returns the "Hello World!" text to the "MyPlugin" Widget.
- (NSString *) getText
{
    // Thanks RRunner :)
    s = [NSString stringWithFormat:@"%s", "Hello World!"];
    return s;
}

// logMessage
//
// Sends the message passed in from JavaScript to the console
// This demonstrates the translation of a JavaScript string to an
// NSString*; in the real world just call alert() from JavaScript,
// which Dashboard sends to Console anyway
- (void) logMessage:(NSString *)str {
    NSLog(@"JavaScript says: %@", str);
}

@end
```

Getting Things Together

Now that you saw the source code of the files that compose the "MyPlugin" Dashboard Widget, I will further explain the necessary parts, functions, and practices for creating a Widget plugin.

First, every Widget plugin should implement the following method so that it can be used from within Dashboard:

```
- (id) initWithWebView:(WebView*)webView
```

Dashboard calls the `initWithWebView` method when a plugin is first loaded. You should initialize your central class and your important data structures inside the `initWithWebView` method.

Second, the WebScripting interface has to be implemented so that the plugin will be able to interact with the Widget. Please see the "WebScripting (informal protocol)" and "Using Objective-C From JavaScript" web links at the end of the chapter for more information.

Also, you have to implement the `windowScriptObjectAvailable` method. The definition of the `windowScriptObjectAvailable` method in the `MyPlugin.m` Objective-C file is as follows:

```
// windowScriptObjectAvailable
//
// This method gives you the object that you use to bridge between the
// Obj-C world and the JavaScript world. Use setValue:forKey: to give
// the object the name it's referred to in the JavaScript side.
- (void) windowScriptObjectAvailable:(WebScriptObject*)wso
{
    // NSLog(@"windowScriptObjectAvailable");
    [wso setValue:self forKey:@"MyPlugin"];
}
```

Apple recommends that you should also implement the `webViewScriptNameForSelector` method, if you want to use Objective-C methods in a more readable format.

```
// webViewScriptNameForSelector
//
// This method lets you offer friendly names for methods that normally
// get mangled when bridged into JavaScript.
+ (NSString*) webViewScriptNameForSelector:(SEL)aSel
{
    NSString *retval = nil;

    // NSLog(@"webViewScriptNameForSelector");
    if (aSel == @selector(getText))
    {
```

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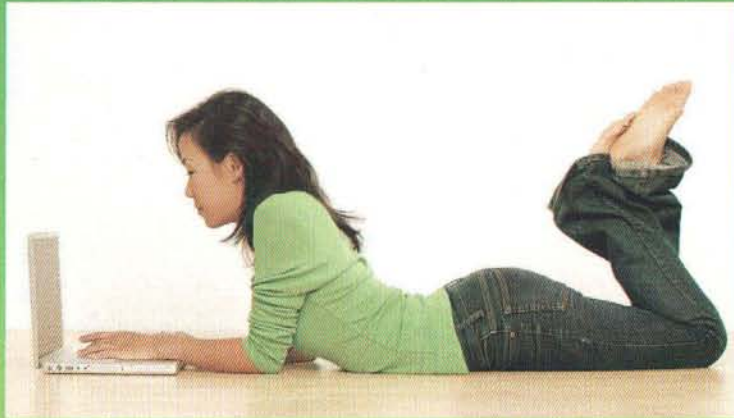
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```

        retval = @"getText";
    }
    else if (aSel == @selector(logMessage:))
    {
        retval = @"logMessage";
    }
    else
    {
        NSLog(@"\tunknown selector");
    }

    return retval;
}

```

You can add method declarations for the `windowScriptObjectAvailable` and `initWithWebView` Objective-C methods inside the `MyPlugin.h` file. It is a good practice although I did not use it for this simple Widget.

Now, let us go on the JavaScript side. The `swapO` JavaScript function does all the communication with the Objective-C side. For an Objective-C object to be accessed from JavaScript, the following practice has to be used:

```

if (MyPlugin)
{
    var line = MyPlugin.getText();
    // drop in the new text
    document.getElementById("quote").innerHTML = line;
}
else
{
    alert("Widget plugin not loaded.");
}

```

As you see, the JavaScript code first examines if the Widget plugin is available. Then, it calls the appropriate Objective-C function and gets its input. The `getText()` function is implemented inside the `MyPlugin.m` Objective-C file.

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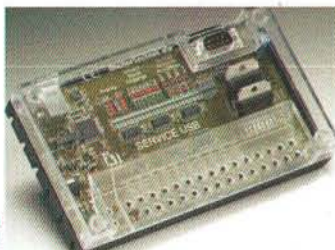
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The `alert()` function call provides debugging information from within the Widget. I should tell you that you can find the output of the alert command in the console window. You can find the Console application inside the `/Applications/Utilities` directory.

Creating the Widget from its parts!

Now, let us say that you have successfully compiled your Widget plugin and it is now time to create your Dashboard Widget. A Widget resides in a directory with the `.wdgt` extension. You may first create a directory called `MyPlugin.widget` (or something different to `MyPlugin.wdgt`!) and put your files there because if you try to open `MyPlugin.wdgt` by double clicking on it, Finder will think that you want to install it. Figure 8 shows the full contents of the `MyPlugin.widget` directory. As soon as you finish copying files, you may rename it as `MyPlugin.wdgt`.



Figure 8. The contents of the MyPlugin.widget directory

First, bring the `MyPlugin.widgetplugin` directory that you made using Xcode. This contains the actual Widget plugin that should be a Universal binary. Then, put `MyPlugin.html`, `MyPlugin.css`, and `MyPlugin.js` files. Last, you should put `Info.plist`, `Default.png`, and `Icon.png` files and you are done! Now is the time to rename the Widget directory from `MyPlugin.widget` to `MyPlugin.wdgt`. You will see some Finder messages, and when you finish it, your directory should have a Widget icon. Double click it to install the Widget, and Dashboard will open automatically.

Figure 9 shows how the MyPlugIn Widget looks inside Dashboard before and after pressing on it.

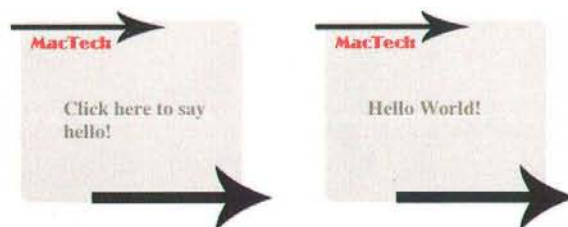
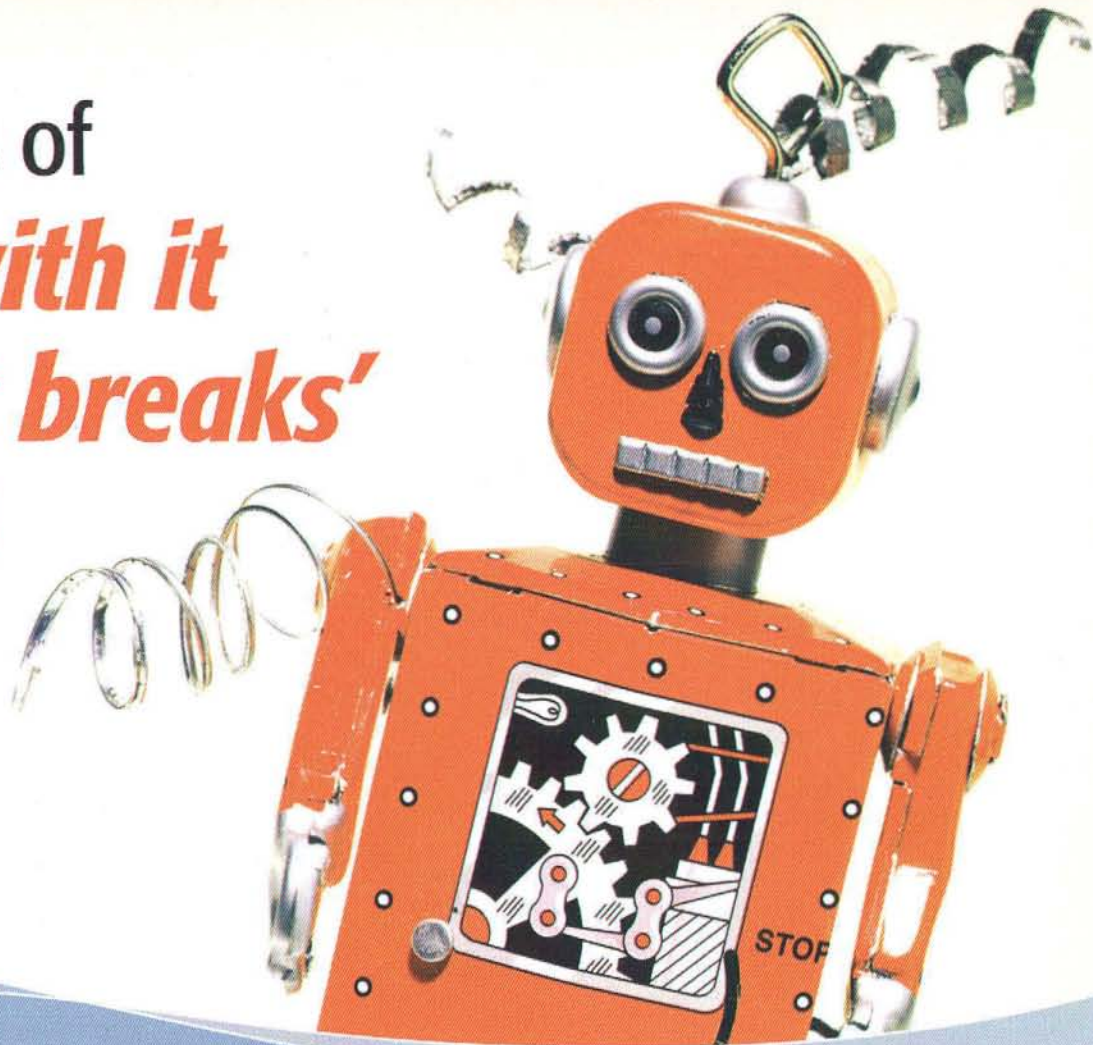


Figure 9. The MyPlugIn Widget inside Dashboard

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Congratulations, your Widget is up and running!

Conclusions

You learned a lot in this article, not all of it being uncomplicated. The main advantage of plugins is that they hide your source code. You can lock your Widget, your Widget can have an expiration date or be a universal binary (keep in mind that if you do a standard Widget without plugins, you should not worry about universal binaries). It is true, though, that all these goods come at a price: you have to learn the powerful Objective-C programming language.

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PATCH PANEL

by John C. Welch

Rolling out Microsoft Office Updates

*Repackaging updates for fun
and sanity*

Hello Again

Well, it's been a while since my particular brand of loquaciousness has graced the pages of MacTech, but like boomerangs and bad pennies, here I am. In this month's installment of Patch Panel, I'm going to chat with you about a subject near and dear to all our hearts; Rolling out updates to Microsoft Office. By "near and dear" I mean, "met with much eye-rolling and groaning". This has nothing to do with Microsoft Office itself. Regardless of your opinion of the suite, the fact is, it's something that most Mac administrators have to support. One of the time honored tediums of the administrator's life is that of rolling out the update. This is something that can either be relatively easy, or a tedious process that makes you wish we could revert back to the good old days of stone tablets and chisels.

Some History

Waaaaay back in the dark ages, (okay, back before OS X), there was nothing as organized as the current Apple installer. Oh, Apple had an installer, but it was not nearly as easy to deal with as the current Mac OS X version. So, sensing an opportunity, several companies came out with their own products, one of the biggest being Installer VISE, from MindVision. (<http://www.mindvision.com>). VISE had a number of advantages over the others, including not just Windows support, but actual acceptance on that platform. This of course, made it rather attractive to a number of companies, including Adobe. Now, while Microsoft had, and indeed, still has their own Windows installer(s), the rest of VISE's feature set made it a good fit for the Mac BU.

Current Issues

So now you have a setup where if something can be installed via an Apple Installer, or direct copy, the administrator's job is simple. If you use Apple Remote Desktop, and it's an Apple Installer, you let Apple Remote Desktop handle it, or copy it over and run the installer command via SSH. If it's a direct copy, then you, well, copy it. Simple, easy, and even allowing for some of the issues with Apple's installer, elegant. With Apple Remote Desktop 3's AppleScript support, I don't even directly interact with Apple Remote Desktop to install these two kinds of items. I just drop them in specific folders and let folder actions handle them. It's pretty sweet, and lets me not waste a lot of time with installing files on clients.

However, when you hit a VISE installer, which is what the Mac BU *still* uses for Office updates, that system breaks, and hard. You have to either manually install it on each machine, or you have to repackage it. Since the former just is not happening unless you have a very small number of machines, we of course, will look at the latter. (Note: While I'm really only talking about Office 2004, this all should work just peachy with Office v.X)

Figuring Out what to Install

As I said before, to most tools, VISE installers are *opaque*. You can see the file, but you can't crack it open and see what's in it, what's going to be installed where, etc. You also can't have a tool like Apple Remote Desktop just install it. Luckily, Microsoft, bless their little IT-centric hearts, gives you a couple of ways to figure this out. The first, best method is via their updater logs. If you look in the Microsoft Office 2004 folder after an update, you'll see a folder called "Updater Logs". Inside that folder, you'll find a text file for each of the updates you've applied to that system. The updater file lists every file that was installed on the system.

Now, before you just run off and blindly use this, by "each file" I mean just that. If it installed ten files inside a bundle, then you get ten entries. Now, you can directly follow the log line for line, but that's kind of the silly way to do it. Instead, read the file, and use it to get the minimum number of files and packages you actually have to care about. Some of the lines are obvious like the ones for the main apps, (this is on my own drive, so it follows my own...unique...filing system. Normally, the Office 2004 folder is in the root of your Applications folder):

Installed Aurora:Applications:Word Processing:Microsoft Office 2004:Microsoft Entourage

Installed Aurora:Applications:Word Processing:Microsoft Office 2004:Microsoft Excel

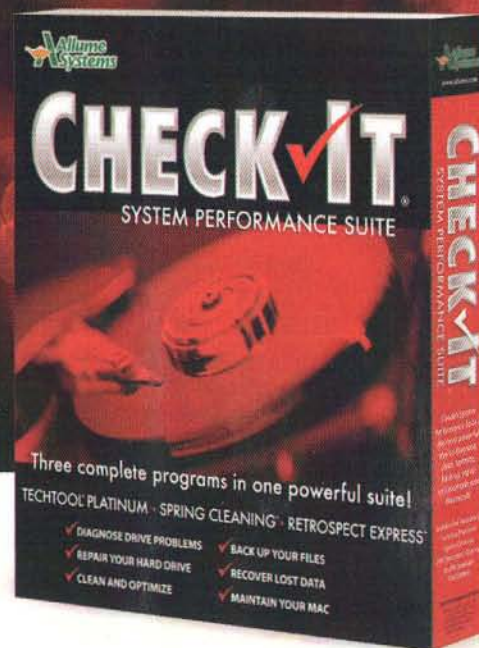
Installed Aurora:Applications:Word Processing:Microsoft Office 2004:Microsoft PowerPoint

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So, we can see it installed new copies of each of the four main applications. Okay, that's easy. But then we see a bunch of lines like the following:

Created the Folder: Aurora:Applications:Word

Processing:Microsoft Office 2004:Office:Microsoft Cert Manager.app

Created the Folder: Aurora:Applications:Word

Processing:Microsoft Office 2004:Office:Microsoft Cert Manager.app:Contents

Installed Aurora:Applications:Word Processing:Microsoft Office

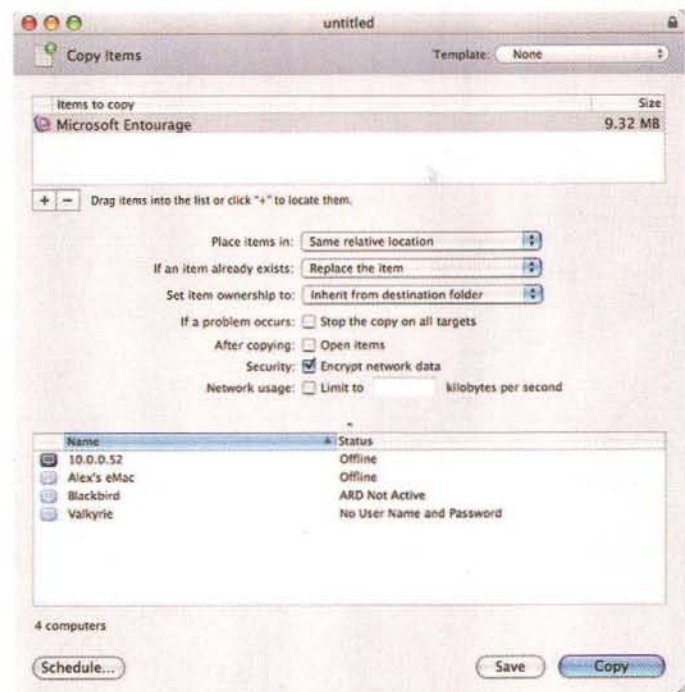
2004:Office:Microsoft Cert Manager.app:Contents:Info.plist

And this goes on for about 30 lines. Does this mean you have to now deal with 30 separate files? Nope. It means you deal with one: The Microsoft Cert Manager.app, which lives in the "Office" folder inside of the main Microsoft Office folder. This can be kind of tedious to parse, although since Microsoft is thankfully consistent in how it does this, you can script this parsing out fairly easily. However, there is an easier way, one that all administrators will of course already know about, and that is the Read Me file.

With every update, the Mac BU has a Read Me file that lists out the files which are updated, and their new versions. (For those of you who are Britannica fans, this is the Macropaedia, whereas the installer log is the Micropaedia.) So rather than parsing through the Updater Log file to figure out what was installed, you can just use the Read Me to see what was installed. It's much simpler. Now, the Read Me won't tell you the specific locations of the files, so it's not a complete replacement for the Updater Log, but that's not a huge issue, depending on how you build your updater.

Building Your Updater

So, we now have two lists of files, one detailed, one not. Now, how do you build the updater? Well, the answer is, "Whatever works best for you". No, I'm not trying to be smarmy, it's just that there are a lot of ways to do this. If you use Apple Remote Desktop, as I do, then you can just do a drag of the files to a list of destination clients, and chose "Same Relative Location" as the destination, like in the screenshot below:



Copy Items Dialog from Apple Remote Desktop 3

Drag all the files you need to copy over, pick "Same relative location", click on copy, and watch the fun. (Yes, I realize none of my targets are currently running or running ARD). You can of course, with Apple Remote Desktop 3, AppleScript this, via Copy Items task. Just set the "location" property to "same relative location" in the properties for the task. You could even set up a Folder Action that would always copy whatever you dropped into it to the Same relative location, and be even lazier. That of course is my preferred method. Life's too short to watch file copies. If you aren't using Apple Remote Desktop, or you prefer using Apple Installer packages, you can use Apple's PackageMaker tool

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to bundle up the update into an install package, and then use that via Apple Remote Desktop or your tool of choice. (There's a PackageMaker article in this very issue, so I'll not get into using PackageMaker, as it would be redundant.)

If you like using Apple's Installer packages, but are not thrilled with PackageMaker, then a third party option is to use Iceberg, (<http://s.sudre.free.fr/Software/Iceberg.html>). Iceberg is billed as a better way to make Apple Installer packages, and in general I've found that to be true. The only issue with Iceberg is that it requires the use of a daemon that runs as root. If that's not an issue for you, Iceberg is worth checking out. I also find the documentation on Iceberg's site to be solid as well, always a welcome touch for an installer builder.

Please don't think that these are the only options out there. When you're talking about straight file copies, which is what updating Office is, once you install it on an initial system, there are as many ways to roll this out as there are ways to copy files. If you're thinking "that's a lot of ways", well, you're right. Once you know where to look for the correct information, then how you get the copies onto the end user system is totally up to you, and your normal workflow.

Two Caveats

There are of course some things to keep in mind that could trip you up. (You knew there would be, nothing's ever *that* simple.) First, the main applications in Office, namely Word, PowerPoint, Excel, and Entourage are traditional dual fork applications. That is, they have a resource fork. That's probably not going to change until the next release of office, still known by its *nom du code* as "Office 12". So, when you're copying Office updates, you *really* want to make sure that whatever method you use doesn't do bad things to resource forks. Otherwise, the applications will break, and your users may do bad things to you.

The other thing to watch out for is the Microsoft Database Daemon. This is a daemon that runs whenever one of the main Office applications is running, or it runs at login if the user is an Entourage user and has set events or tasks with reminders. If you update the Microsoft Database Daemon while it's running, and there are changes made to it, then the end users, particularly Entourage users could get odd messages that might lead them to think their Entourage database died. That would make them flustered and stern, especially if they find out later that it was just an update doing this. Since the daemon only runs within a user login context, the obvious solution is to not run the update until the users have logged out. If this isn't possible, then I'd highly recommend adding a post install action that restarts the daemon.

Conclusion

If this all seems pretty simple, well, it is. While the Mac BU really, really, *really* needs to move to Apple Installer packages sooner than later, their laudable habit of providing detailed installer logs, and updated file lists in the update readmes makes what could be an onerous task into one that's just mildly tedious

and annoying. As long as you keep my warnings about resource forks and the Database Daemon in mind, rolling out Microsoft Office updates shouldn't be hard at all.

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John Welch <jwelch@bynkii.com> is Unix/Open Systems administrator for Kansas City Life Insurance, (<http://www.kclife.com/>) a columnist for Datamation, (<http://itmanagement.earthweb.com/columns/apleent/>) and the "GeekSpeak" segment producer for Your Mac Life, (<http://www.yourmaclife.com/>). He has over fifteen years of experience at making Macs work with other computer systems. John specializes in figuring out ways in which to make the Mac do what nobody thinks it can, showing that the Mac is a superior administrative platform, and teaching others how to use it in interesting, if sometimes frightening ways. He also does things that don't involve computertry on occasion, or at least that's the rumor.



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Distributing with PackageMaker

Building a distribution installer package

By Jose R.C. Cruz

Introduction

Software product quality is judged on several factors. Firstly, the product must provide the features needed by users to do their tasks effectively and efficiently. Secondly, it must provide a localized user interface that is both consistent and intuitive. Thirdly, it must be accompanied by an extensive online help system, explaining each feature in simple and concise terms.

Finally, the product must be easy to install or upgrade. It is a harsh fact that high-quality software is easily marred by poor installation and buggy upgrade experiences. This is especially true with Windows software, which can fail when a file is incorrectly installed, or replaced by an older and perhaps faulty version.

The MacOS X issue

Most MacOS X software is distributed as bundles. A bundle is a special directory used to contain files that comprise the software product. For a software application, the bundle will contain the executable code, driver code, graphic files, and help files. For a software driver, it will contain the executable code, and a collection of plist, or property list, files.

Because of bundles, different techniques are required to distribute MacOS X software. The simplest one is to distribute the software as an archived file. The most popular archive formats in use are .sit, .zip, and the ever-popular .gz.tar (also known as the *tarball* format). Users download the archive file, and decompress it to retrieve the software product. They then manually move the product to the desired directories. This technique is often used for distributing freeware and shareware products.

Another technique is to distribute the software as a *disk image file*. When the file is double-clicked, it is mounted on the Finder desktop like a regular disk volume. Users can then move the software from the image to the desired directory. This technique is popular for distributing single software applications.

However, both techniques expect users to know beforehand if their systems can run the software product. Both also expect users are also expected to know how to set the file or directory permissions if required. Finally, neither technique can be localized for a specific region.

To address these issues, Apple provides the tool to create an installation package that is both localizable and scriptable. The name of the tool is *PackageMaker*.

Introducing PackageMaker

The PackageMaker Tool

The PackageMaker tool is used to prepare software products for distribution. It creates a specialized bundle, called

a *component package* (.pkg) to contain the software product or *payload*. The package is then processed by the Installer application, which is bundled in all MacOS X systems. It is this application that extracts the payload and moves it to the appropriate directories.

To learn more about component packages, read the *Software Delivery Guide* manual, which is available from Apple Computers.

Two other types of bundles that can be created are *metapackages* and *distribution* packages. Both are used to contain multiple component packages. They also allow users to select which payload to install on their computers.

Until recently, a metapackage is the only way to distribute multiple payloads to the public. This is no longer the case with MacOS X 10.4, and the more manageable distribution package.

The PackageMaker Competition

PackageMaker is not the only installer tool available for the MacOS X platform. Other companies also provide their own installer products for that platform. Three of the most popular ones on the market are InstallerMaker, InstallerVise, and InstallAnywhere.

All three installer products use proprietary algorithms and file formats to contain their payloads. Also, InstallerMaker and Installer Vise will correctly handle files that have resource forks. Both Installer Vise and InstallAnywhere also provide a feature called billboards. These are used to display additional information while the payloads are being installed.

Finally, all three products can create installers that are localized for multiple regions. Also, InstallerVise and InstallAnywhere can create installers for multiple platform targets. InstallerMaker, on the other hand, supports MacOS X as its sole target platform.

Pricing for InstallerMaker and InstallerVise are based on a per volume basis. It can range from \$250 to \$3000 a year, depending on the distribution volume of each payload. On the other hand, InstallAnywhere can be purchased for a one-time fee of no more than \$3500. InstallerVise can also be purchased for a one-time fee, but only if it is used for in-house or educational projects.

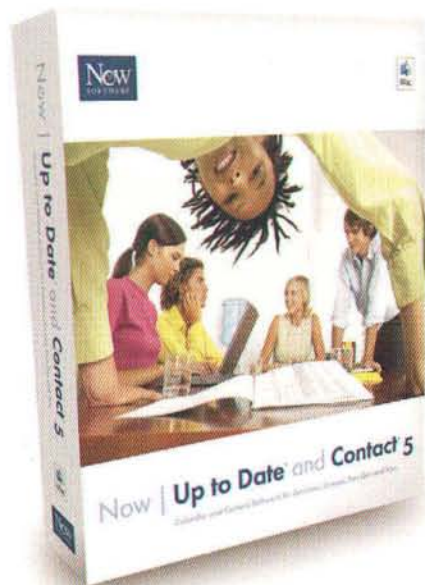
For an open-source alternative, there is the *Iceberg* tool from Stéphane Sudre. This tool can also be used to create component packages and metapackages. It also has a more streamlined interface for supporting localization and scripting. It can even create metapackages without the need for component packages. Its only disadvantage is that it does not support distribution packages. However, this could change in future versions. [Ed. Note – also be aware that Iceberg requires a

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daemon that runs as root, and that makes some people uncomfortable. That said, Iceberg has an easy to use UI that makes creating packages very easy.]

The PackageMaker Advantage

The most notable advantage of the PackageMaker tool is that it is *free*. Developers only have to download the latest version of Xcode to get a copy of this tool. However, the download does require a high-speed connection. This is because the entire Xcode installer itself is nearly 1GB in size. It would be more convenient for some developers if PackageMaker can be downloaded separately.

Another advantage is the ease in which the tool supports localization. Localized copies of Readme and Software License files can be loaded into the appropriate .lproj bundle. Text used by some interface elements, such as warning dialogs, can also be localized using a .string file. Also, testing the localized package is as simple as changing the preferred language setting in System Preferences.

Finally, the tool allows scripts to be added to the installer package. Each script is executed by the Installer application at each stage of installation. The scripts are often used to perform platform checks, or to customize the installation.

The Distribution Package

The package format

The distribution package is the preferred format for handling multiple payloads for MacOS X 10.4 and newer. It provides a more organized storage for localized text and installer scripts. It also allows installation choices to be easily customized.

The structure of a basic distribution package is shown in Figure 1. Notice that each component package is now stored within the Packages directory. Also, notice that the Resource directory now only stores the .lproj bundles. As mentioned earlier, these bundles contain localized installer files such as the ReadMe and Software License files. Finally, the XML file, distribution.dist, will now contain the localized text and installer scripts.

You can still use a metapackage to deliver multiple software payloads. But, be aware that this format is now deprecated, and will be phased out in future versions of MacOS X. Use it only if you plan to support versions of MacOS X earlier than 10.4.

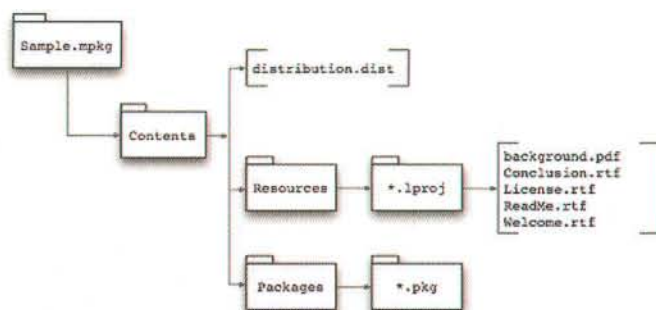


Figure 1. Structure of a distribution package bundle.

Creating the project

To start working on a distribution package, launch PackageMaker and choose New from the File menu. Select Distribution Project from the New Project Assistant (Figure 2) and click on the OK button. PackageMaker will then display an empty project window as shown in Figure 3. Make sure to save the installer project with the appropriate name.

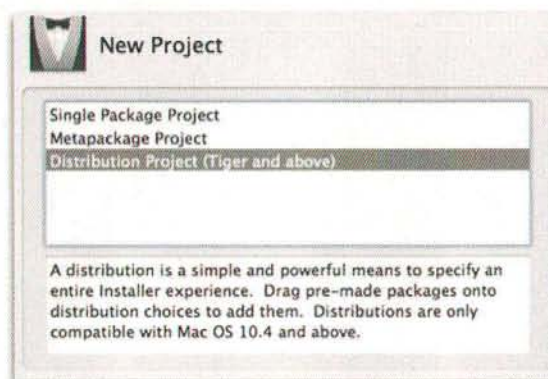


Figure 2. The PackageMaker Assistant.

Do not use the Assist Me button to create a project for your distribution package. At the time of this writing, assistive support only exists for component packages and metapackages. Hopefully, support for distribution packages will be added by the time you read this statement.

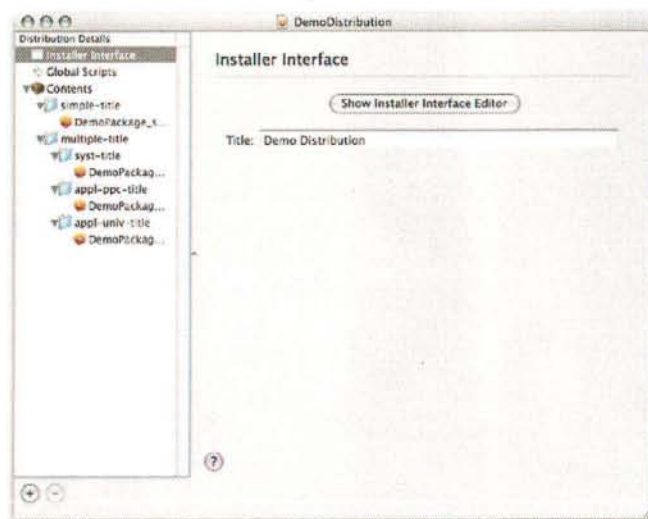


Figure 3. The Distribution Package project window.

Defining the interface

As shown in Figure 3, the first panel displayed in the project window is Installer Interface. This is where you assign the official title of your distribution package. It is also where you define the user interface for your package. To start defining on your interface, click on the button labeled Show Installer Interface Editor. Then follow the instructions presented by each editor panel.

Three issues to keep in mind while working on your installer interface. First, the project always assumes that the package is localized for English. This is regardless of the current language set in System Preferences. In other words, even if the current language is set to French, localized files assigned to the project will be stored within an `English.lproj` bundle.

Second, the project accepts background image files rendered only in one of the following formats: EPS, GIF, JPEG, PDF, and TIFF. It will not accept PNG files, nor will it convert those files to one of the supported formats.

Finally, the project does not allow additional `.lproj` bundles to be easily added to it. The only workaround is to first build the distribution package. Then open the package using the contextual menu command, `Show Package Contents`. Once opened, the `.lproj` bundles can then be copied into the Resources directory of that package.

Hopefully, these three issues will be corrected in future versions of the PackageMaker tool.

Defining choices

Most of the time, your installer package only has a single payload to distribute to your users. This is especially true if the payload is a single self-contained application. Sometimes, however, your package may have more than one payload. In this case, you may want your users the option of choosing which payload to install. You may also want your installer package to decide which payload can be installed onto the target platform by default.

The PackageMaker tool now allows you to define the interface for installation choices. You can specify whether to provide an `Easy Install` or a `Custom Install` option. You can also specify which payload should be selected by default. Bear in mind that this feature is available only for the distribution package format.

The simplest way to define the interface for installation choices is to use the `Contents` panel (Figure 4) on the `Installer Interface Editor`. Through this panel, you can add, edit, or remove an installation choice. For example, click on the button labeled `Add Choice` to add a placeholder entry for a new choice. To edit, select the choice from the listbox and change its name or default states using the `Contents Inspector`.

You can also use the panel to select the default installation mode. Simply select the desired mode from the drop-down menu labeled `User Sees`. Choices include `Easy` and `Custom Install`, `Custom Install only`, and `Easy Install only`.

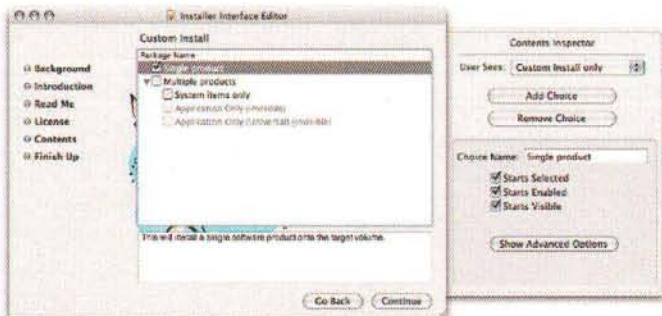


Figure 4. Defining installation choices.

Finally, you can also use the panel to create a hierarchical order of installation choices. Simply select a choice and move it to the desired spot on the listbox. Currently, there are no established limits to the number of hierarchical levels. But a good rule of thumb is to have *no more than three levels* of choices for visual reasons.

The example shown in Figure 4 has four installation choices defined. The `Single product` choice will install a single payload. It is also set as the default installation choice.

The `Multiple products` choice will install two payloads. It is further divided into three more choices, each one associated with a different payload. Notice that two of those subchoices are set to be invisible by default. A script will be used to display the appropriate subchoice based on the target platform. This will be explained later in this article.

Adding payloads

Whenever you add an installation choice, the PackageMaker tool also adds an entry for that choice in the project window. To assign a payload to an installation choice, first select the choice from the listbox. Then choose `Add Package` from the `Project` menu to display the file selection dialog. Navigate to the component package for the payload and click on the `Open` button to select it. Additional details on the assigned payload are then displayed using the `Package Settings` panel (Figure 5).

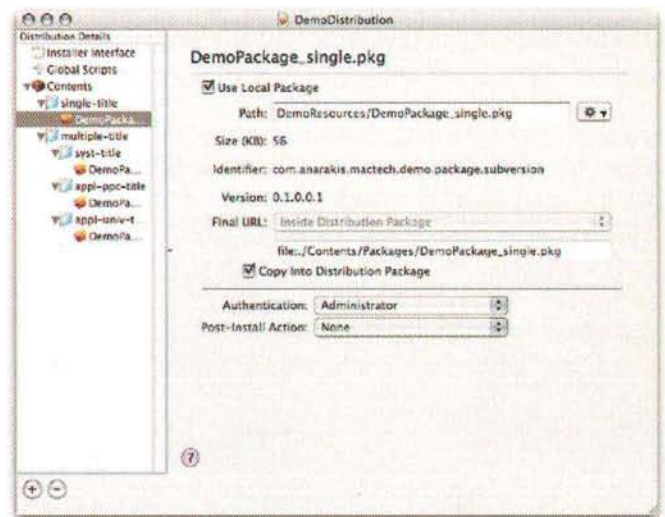


Figure 5. Details on the assigned payload.

In the example shown, the panel identifies the assigned payload as a local component package. It displays the size, bundle identifier, and version number of that package. It also shows that the package will be located inside the `Packages` directory. It further shows that installing the package will have to be authorized by the system administrator. It also shows that the `Installer` application will simply quit after installing the payload.

You can use the `Package Settings` panel to specify a different location for the payload's component package. One location is the *same directory as the distribution package*. Use this if you want users to be able to install the payload directly from the component package.

Another location for a component package is on a *removable media*. Use this option if your payloads are large enough that they cannot all fit into a single CD or DVD. One usage example is the CD distribution of MacOS X.

The third and final location is on a *network server*. Use this option if you want to do a network installation. A good usage example is the software update feature of MacOS X.

Note that these other locations are available only if you deselect the checkbox labeled Copy Into Distribution Package.

Others settings that you can make on the Package Settings panel are the *authentication* and *post-install* actions for the payload. The former action is executed *before* the payload is installed. The latter action, on the other hand, is executed *after* the payload is successfully installed.

If the payload has its own authentication or post-install action, those actions are displayed on the Package Settings panel. You can then change the type of authentication to be performed, but you cannot disable it. You can also change the type of post-install action as well as disable it entirely. These changes then override the settings used by the payload.

Localizing choices

When choices are defined through the Contents panel (Figure 4), the PackageMaker tool always assumes that the choices are localized for English. To localize these same choices to other languages, you need to use the Choice Settings panel (marked in green, Figure 6) on the project window.

To localize a specific choice, select the choice from the listbox located on the project window. Then click on the checkbox labeled Make localizable. The tool then assigns unique string identifiers for each text field. It also replaces the English text contained by these fields with the identifiers. But the replaced text is still available for editing as seen later on.

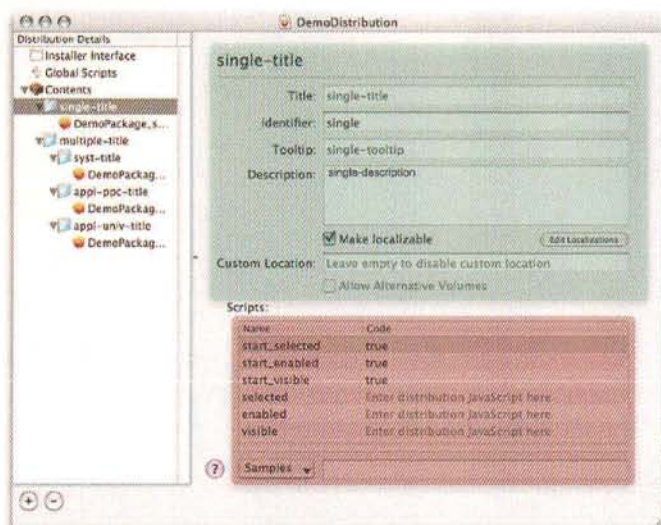


Figure 6. The Choice Settings panel.

Now to start adding localized text, click on the button labeled Edit Localizations. This will display a sheet dialog wherein you can enter your text. It will also display the original English text on that same dialog by default (Figure 7).



Figure 7. Localising the text for the installation choice.

In the Language text field, enter the designation code assigned for the target language. For instance, if you are localizing for French, enter the word **French** into the field. But, if you are localizing for Portuguese, enter the characters **pt** into that same field. These designation codes are part of the ISO-639 standard. For a complete list of language designations, go to <http://icweb.loc.gov/standards/iso639-2/englangn.html>.

Figure 8 shows an example of the installation choice text localized in French. Once you have entered the localized text, click on the Close button to submit your entries. The tool will save the localized text into the `distribution.dist` file when it builds the distribution package.



Figure 8. Localising for French.

Once you have finished defining the interface, choices, payloads, and localizations, you can build a distribution package to see the results. To build the package, choose Build from the Project menu. Then use the ensuing dialog to save the package into the appropriate location.

The Distribution Scripts

Controlling the Installer

As mentioned earlier, the distribution package uses scripts to control the installation process. These scripts can perform a variety of tasks such as validating the target platform, or checking to see if a target volume has enough space.

Figure 9 shows how the scripts are executed in a typical installation process. User actions that are enclosed in *[square brackets]* are considered optional.

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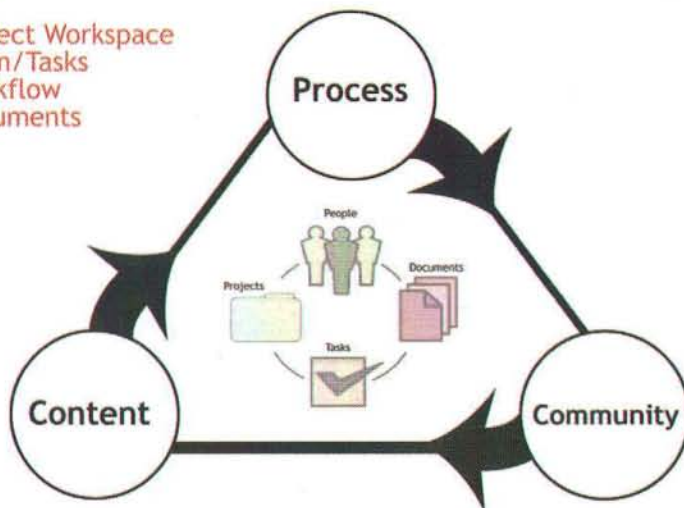
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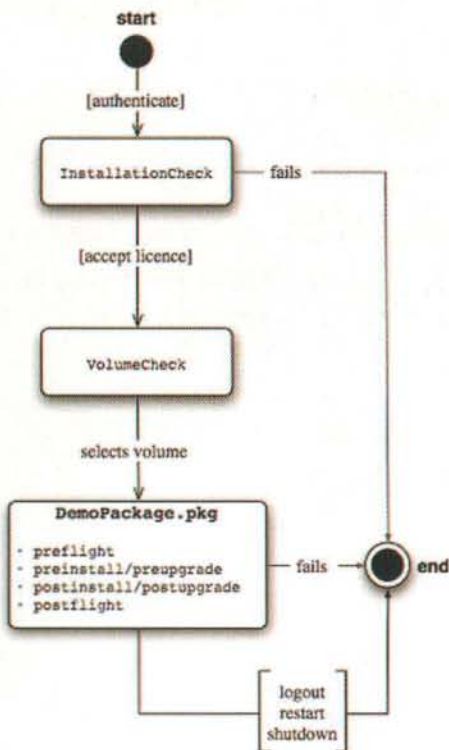


Figure 9. Script execution within a distribution package.

After the user authenticates the installation process, the *InstallationCheck* script is executed. This script checks the target platform to see if it has the requirements necessary to support the payload. If the target passes the check, the software license agreement is then displayed to the user.

When the user accepts the terms of the agreement, the *VolumeCheck* script is then executed. This script tests every mounted volume to see if they have the storage capacity to contain the payload. Those volumes that fail the test will have a stop icon badge appended to their disk icon.

At this point, the user selects a target volume. Then, the component package is retrieved from the Resources directory. The preflight script of the package is first executed. Then, depending on the type of installation, the preinstall or preupgrade script is executed next. Once the payload is successfully installed, the postinstall or postupgrade script is executed. Finally, the postflight script of the package is executed to finish the installation. Afterwards, the desired post-install action is then performed.

Note that if either the *InstallationCheck* script or one of the package scripts fail, the entire installation process is then cancelled. Also, if the component package does not have any scripts, the post-install action is then performed after the payload is installed. But if it has its own *InstallationCheck* or *VolumeCheck* scripts, they are then ignored.

For the sake of simplicity, the diagram assumes that there is only one component package. If there is more than one package, their scripts are executed in a specific order. For instance, if the package names are *package1* and *package2*,

the preflight script for *package1* is executed first. This is then followed by the one for *package2*.

Scripting with JavaScript

Distribution scripts are all written in JavaScript. This allows the scripts to be embedded within a separate document. The distribution package, for instance, stores its scripts inside the *distribution.dist* file.

JavaScript enables the scripts to interact with the control widgets on the installer interface. It helps reduce the number of installation errors with its exception handling system. It also simplifies script maintenance by using a standard runtime library. Make sure to use version 1.2 of the language when writing your scripts.

Both the PackageMaker tool and the Installer application use the same runtime library. This library provides *three basic objects* that can be used by the distribution script. The *choices* object is used to interact with the installation choices defined by the Contents panel (Figure 4). The *system* object is used to retrieve various platform data such as file paths, and IORegistry entries. It is also used for debugging and for executing external scripts.

Finally, there is the *my* object. This special global object is used to reference the current context of the JavaScript process. For instance, the *my.target* context refers to the current target volume. The *my.result* context refers to the results of the last *InstallationCheck* or *VolumeCheck* script.

A complete listing of all the library methods is beyond the scope of this article. Instead, six of the most commonly used methods are listed as follows.

- *my.target.availableKilobytes* — Checks the amount of free space available on the target volume. Returns the value in kilobytes as an integer.
- *my.target.systemVersion* — Checks the version of MacOS X installed on the target volume. Returns the version number as a string.
- *system.file.fileExistsAtPath(aPath)* — Checks to see if the specified file is present. The input argument, *aPath*, is entered as a UNIX path string. Returns a TRUE if the file exists, FALSE if otherwise.
- *system.gestalt(aSignature)* — Checks on a specific system setting using the Gestalt Manager. The input argument, *aSignature*, is a four-character identifier. Returns the result as a JavaScript object.
- *system.log(anArg)* — Outputs a string, prefixed with the characters JS:, to the PackageMaker's debug console. The input argument, *aArg*, can either be a string or a JavaScript object.
- *system.sysctl(aNode)* — Returns the setting of a specific kernel state. The input argument *aNode* is the string describing the kernel state node.

For a more complete list of library methods, read the *Installer Release Notes*, which can be found at <http://developer.apple.com/releasenotes/DeveloperTools/Installer.html>.

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The Global Scripts panel

The Global Script panel (Figure 10) is where you define your distribution scripts. Also, it is where you select which scripts to use as an InstallationCheck or a VolumeCheck script.



Figure 10. The Global Scripts panel.

The project template for the distribution package contains three basic scripts. Each script performs a default action, which are described as follows.

- `installationCheckRAM()` — Checks if the target platform has at least 128 MBytes of physical RAM installed.
- `volumeCheckTiger()` — Checks if the target system version is at 10.4 or newer.
- `choiceIsADowngrade()` — Checks if the user is about to perform a downgrade installation, as opposed to an upgrade.

Both scripts return a TRUE if their conditions are valid, FALSE if otherwise.

To edit a script in the Global Script panel, select its name from the list and click on the button labeled Edit. To add a new script, click on the plus-sign button located on the lower-left corner of the list, and enter the script's name in the space provided. To remove a script, select its name from the list and click on the minus-sign button.

To select the script for the InstallationCheck, type its name into the appropriate field. Use the same procedure for selecting the script for the VolumeCheck. Alternatively, you can select the name of the script from the drop-down list next to each field.

Scripting installation choices

Scripts can reconfigure the default installation choices based on the target system environment. They can also reconfigure other choices based on user input. They can even check for specific software products, and then enable choices, such as bridge software, that will interact with those products.

For example, a distribution package carries two versions of the same software product. One version is suited only for PowerPC-based systems, while the other is for Intel-based systems. A script can check the target processor type. It can then hide and show the appropriate installation choice based on the results of the check (Listing 4).

Assigning a script to an installation choice is done through the Scripts listbox (encircled in red in Figure 6) of the Choice Settings panel. Note that the first three entries in the listbox have a `start_` prefix. These correspond to the three default states of that installation choice. Usually, you set the default states using the Contents panel (Figure 4). You can also set those states by double-clicking on each entry, and entering either a TRUE or FALSE value.

The next three entries also correspond to each state of the installation choice. These ones are scriptable. To assign a script for each entry, double-click on the adjoining field to bring up the script window. Then enter the name of the global script in the window provided.

Do not define a distribution script for the installation choice through this window. If you do so, the distribution package will generate a JavaScript error at runtime. Use the Global Script panel to define the script.

Defining a distribution script

The script window (Figure 11) is where you create or edit your distribution script. It is displayed whenever you select a script from the Global Functions listbox (Figure 10) for editing.

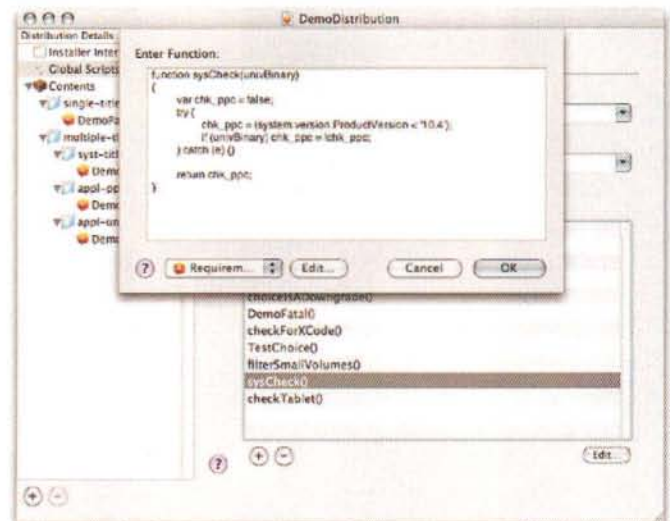


Figure 11. Editing a distribution script.

You can enter the JavaScript code directly onto the script window, or use the built-in Requirements Editor. You can also use an external text editor to write or edit your distribution script. Regardless of which approach you use, be aware that you can only edit one script at a time.

To use an external text editor, select its name from the drop-down list, and then click on the Edit button. PackageMaker first saves a copy of the script into a temp directory. It then opens the copy using the selected editor. Any



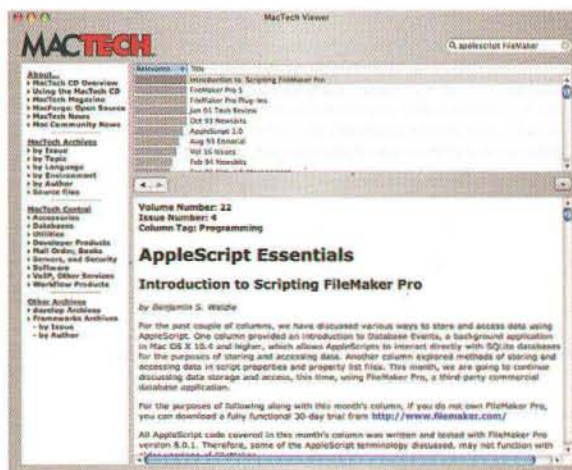
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changes made to the script are automatically reflected back into the script window.

Using an external text editor allows you to take advantage of the editor's various features. For instance, BBEdit will allow you to perform search and replace operations that are not possible in the script window. It will also assign colors to each JavaScript keyword thus making the script easier to read.

At the time of this writing, PackageMaker will use one of the three external editors: BBEdit, BBEdit Lite, and TextWrangler. Future versions of the tool may allow users to add additional editors such as jEdit and Smultron. It may also allow the script to be open by default with an external editor, instead of the script window.

To use the built-in Requirements Editor, select its name from the drop-down list, and then click on the Edit button. PackageMaker then displays the editor's dialog panel as shown in Figure 12.

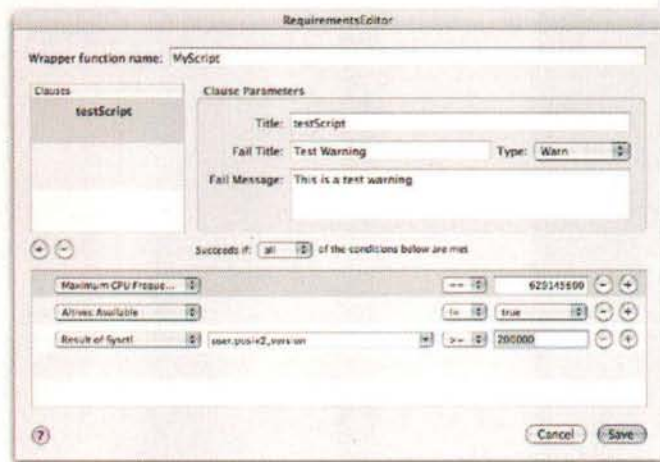


Figure 12. Using the Requirements Editor.

In the above example, the Requirements Editor is used to define the script named MyScript. This script executes a single subroutine named testScript. The subroutine then performs three system checks. It returns a TRUE if the target platform meets the following conditions:

- it has a processor clock speed of exactly 600 MHz,
- its processor does not support AltiVec technology, and
- its BSD subsystem is compatible with at least version 2.0 of the POSIX standard.

But, if the target platform fails to meet any of these conditions, the script will display the appropriate warning message.

When the Requirements Editor is used to define a script, it adds a property list to that script. This property list defines the editor settings that were used for that script. Avoid making changes to this list if you still want to edit the script using the Requirements Editor.

Examples of distribution scripts.

One example of a distribution script is shown in Listing 1. This script is often used to perform an InstallationCheck.

The script checks the target platform to see if the Xcode development environment is installed. If the check fails, the script then displays an error dialog to the user. Once the user

replies to the dialog, the script then tells Installer to terminate the entire installation process.

Listing 1. Checking for the XCode development environment.

```
function checkForXCode() {
    var chk_flag = false;

    try {
        chk_flag = (system.files.fileExistsAtPath '~
        ('/Developer/Applications/Xcode.app') == true);
    } catch (e) {}

    if (!chk_flag) {
        my.result.type = 'Fatal';
        my.result.title = 'XCode Not Installed';
        my.result.message = '
        The installer requires the XCode environment to be
        installed.';
    }
    return chk_flag;
}
```

Listing 2 shows a second example of a distribution script. This one is commonly used to perform a VolumeCheck.

The script checks to see if the target volume has a maximum capacity of less than or equal to 256 Mbytes. If the volume meets the size condition, the script returns a TRUE. If it returns a FALSE, a stop badge is displayed on the disk icon for that volume.

Listing 2. Filtering out volumes less than 256 MB.

```
function filterSmallVolumes()
{
    var test_flag = false;
    var test_limit = 256 * 1024 * 1024;
    var test_size = 0;

    try
    {
        test_size = my.target.availableKilobytes;
        test_flag = (test_size <= test_limit);
        system.log('filterSmallVolumes:size:' + test_size);
    }
    catch (e)
    {
        system.log(e.name);
        system.log(e.message);
    }

    if (!test_flag)
    {
        my.result.type = 'Fatal';
        my.result.title = '';
        my.result.message = '';
    }
    return (test_flag);
}
```

A third example of a distribution script is shown in Listing 3. This example shows how a script can perform a device check.

The script uses the IORegistry to see if a specific USB device is installed on the target platform. In this example, the device happens to be a Macally graphics tablet. If the tablet is installed, the script returns a TRUE. Otherwise, it returns a FALSE, and displays a warning dialog to the user. Unlike Listing 1, the script does not terminate the installation process after the user replies to the dialog.

Listing 3. Checking for a USB graphics tablet.

```
function checkTablet()
{
    var chk_flag = false;

    // perform the hardware check
    try
    {
        var chk_test =
system.ioregistry.fromPath('IOService:/MacRISC2PE ~
        /pci@f2000000/AppleMacRiscPCI/usb@1B/AppleUSBOHCT
        /Macally Mini Tablet@1b100000');
        chk_flag = (chk_test != null);
    }
    catch (e)
    {
        // handle the resulting exception
        my.result.type = 'Fatal';
        my.result.title = e.name;
        my.result.message = e.message;
    }

    // was the check successful?
    if (!chk_flag)
    {
        my.result.type = 'Warning';
        my.result.title = 'No graphics tablet';
        my.result.message = 'The software being installed
requires a ~
        graphics tablet for the best user experience.';
    }
    return (chk_flag);
}
```

Finally, Listing 4 is an example of a script that will interact with an installation choice. This script is used by entering its name into the visible field of the Scripts listbox (Figure 13) of the Choice Settings panel.

The script takes a single input argument named `univBinary`. It first checks to see if the current system version is less than 10.4. Next, it checks `univBinary` to see if it is set to `TRUE`. If this is case, the payload is a Universal Binary, and the variable `chk_ppc` is then inverted. The script then returns the final state of `chk_ppc`.

Listing 4. Selecting an installation choice.

```
function sysCheck(univBinary)
{
    var chk_ppc = false;
    try {
        chk_ppc = (system.version.ProductVersion < '10.4');
        if (univBinary) chk_ppc = !chk_ppc;
    } catch (e) {}

    return chk_ppc;
}
```

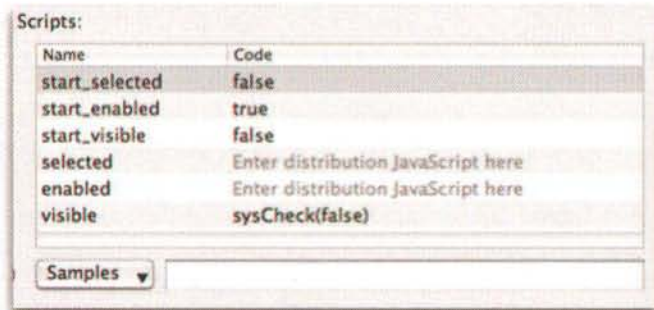


Figure 13. Selecting a choice.

Concluding Remarks

The PackageMaker tool is used to prepare software products for installation. This tool is available free from Apple as part of its Xcode development environment. It builds an installer package that is localized for different languages. It also uses scripts to enhance the installation process.

The latest version of the tool now supports the distribution package format. This new format is the preferred approach for handling multiple payloads on MacOS X 10.4 and newer. It is easier to localize, and allows installation choices to be customized. It also adopts JavaScript as its scripting language. This enables its scripts to interact with the installer interface, and makes the scripts easier to maintain.

The distribution package is the preferred format for installing multiple software payloads. Though it has some issues, it is still easier to localize compared to a metapackage. It allows multiple installation choices to be customized, and it simplifies the assignment of payloads to each choice. The package format also uses JavaScript as its scripting language. This allows the scripts to interact with the user interface, and perform tasks that are difficult to do using either shell or Perl.

The examples shown in this article are part of the DemoDistribution project. This project, together with its payloads, can be downloaded from the MacTech website at the following URL: [place URL here](#).

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About The Author

JC is a freelance engineering consultant and writer currently residing in North Vancouver, British Columbia. He divides his time between developing custom OS X applications, writing technical articles, and teaching origami at his local district's public library. He can be reached at anarakisware@cashette.com.

MAC IN THE SHELL

by Edward Marczak

I Heart vi

Text editing in a shell

Introduction

It's amazing that a basic function like text editing can be so...obscure. *vi* and *emacs* have confounded new users since they arrived on the scene. However, editing text is such an important part of any Unix or Unix-like system, that I'd be remiss if I didn't address it. This month, I'll cover basic *vi* – enough to make you comfortable the next time you've ssh-ed into a remote machine and need to edit a file.

Growing Up

Practically each month, this column asks you to type something into a text editor. Of course, this can be TextWrangler, SubEthaEdit or even Dreamweaver or the XCode IDE. But if you already have a shell open, or, *only* have the option of a shell, then an editor like *vi*, *emacs* or *pico* are your best options. I'm well aware of the *vi/emacs* debates. *Emacs* is truly a Swiss Army Knife of an application. Perhaps I'll cover it someday. However, for some reason, I just dug into *vi* more, and have stuck with it; Turns out to have been a useful choice. If you've ever needed to alter privileges for *sudo* users, you'll note that the 'right' way to edit the *sudoers* file is by using *visudo* – basically, a stripped down version of *vi*. On other Unix systems, there's typically a *vipw* and *vigroup* app. All three, by default, use *vi* as the editor. Also, ever notice which editor you use when editing crontabs with *crontab -e*? So, *vi* is very good to know – at least the basics.

Quick little secret before we start: traditional *vi* is pretty much gone, and has been supplanted with *vim*, *VI* Improved. You'll note that *vi* is simply a link to *vim*:

```
$ ls -ld /usr/bin/vi*
lrwxr-xr-x 1 root wheel      3 Jan 18 2006 /usr/bin/vi -> vim
lrwxr-xr-x 1 root wheel      3 Jan 18 2006 /usr/bin/view -> vim
-rwxr-xr-x 1 root wheel 2060380 Dec 25 2005 /usr/bin/vim
lrwxr-xr-x 1 root wheel      3 Jan 18 2006 /usr/bin/vimdiff -> vim
-rwxr-xr-x 1 root wheel    1068 Dec 25 2005 /usr/bin/vimtutor
-r-xr-xr-x 1 root wheel    34472 Dec 25 2005 /usr/bin/vis
```

OS X v10.4 ships with *vim* v6.2. You can download the latest – version 7 – and compile it up, as it compiles and runs cleanly

under OS X. However, there's no need to do that to follow this particular column.

The Tower That Ate People

If you've never used *vi*, we'll take it step-by-step. So, open up your favorite terminal app and get a shell. You may as well stay in your home directory, as we're not going to make too much of a mess.

To start the editor, simply type *vi*, and you'll be greeted with a startup screen. Unlike Word or Pages, you can't simply start typing. Well, you *can*, but each keystroke may not do what you expect. Those of us that go back to Mac OS 9 will remember *modal dialogs*. Basically, a modal dialog box stopped you from using anything else until you acknowledged it. You were put in the mode of having to deal with whatever message it presented. *vi* is a modal editor. You'll either be in one of three modes: normal mode, 'edit' mode, or ex command mode. What you're looking at now is normal mode: *vi* awaits your instruction.

Press *i*. Now, I should tell you here that commands in *vi* are case sensitive. Typically, the lowercase version means one thing, and the uppercase/shifted version negates, or is the opposite of the lower case (or, non-shift) version – this makes commands a little easier to remember. So, you've pressed *i*, and you now see “— INSERT —” at the bottom of the window. Great! Your first *vi* command. No sweat, right? Now you're in *insert mode*. This is pretty much what you expect. Go ahead, type. How about we all type the same thing. We'll start out easy; try this, pressing return at the end of each line, mistakes and all:

```
trust a few people
love all
do wrong to none
```

Not too terrible, right? Pressing the *escape* key on your keyboard will put you back in normal mode. The “— INSERT —” should disappear.

Now, I didn't get the quote quite right. Let's fix it. Apple has nicely mapped most keys sanely; they do what you expect. This includes the arrow keys. However, this may not be the case on all systems, so, if you'd like to get used to the *vim* way, I'll show you now. This will also help your *Nethack* skills (<http://www.nethack.org>). *k* is cursor up, *j* is cursor down, while *h* moves the cursor left, and *l* moves it right. Perhaps not the easiest to remember. Different people have different ways to remember this, but, I simply suggest a Post-it note and some practice. Why these keys? *Vim* and *vi* strive to be efficient editors. I love to use *vi* as I never have to take my hands off of the keyboard, nor stray too far from the home row. *That's* efficiency. If you're 100% Mac-dedicated, though, the arrow keys will suit you just fine, too. Digression aside, please move the cursor to the first character, the 't' in 'trust'.

Well, if that's the beginning of a sentence, it should be uppercase. There's two ways to tackle this, and we'll start with the easier of the two. With the cursor on the 't', press ~ (tilde). This toggles the character under the cursor between upper and lower-case, and then advances the cursor. Ah, but wait, that's not the correct beginning of

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that quote! With your cursor on that line, type `dd`, which will delete the line and place it in the *yank buffer*. Now, press `p` which pastes the contents of the yank buffer on the line following.

Now, our capital letter leads the second sentence, which naturally isn't right. Twiddle it back using the tilde key (`~`). Cursor up and onto the 'l' in 'love', and we'll replace it with an uppercase version – this time, though we'll do just that: replace. Type `r`, followed by `L`. `r` will replace one character. So, when you typed the `L`, you simply replaced what was there. Time for the correct punctuation.

With the cursor still on the first line, type `A`, for 'append to end of line' (make sure it's capital A!). Your cursor will jump to the end of the line and you'll enter insert mode – look for the "— INSERT —" message in the status line. Type a comma, and press escape to get back into normal mode.

Cursor down to the second line, and then right to the 'p' in 'people'. Delete, one character at a time using the `x` command, the word 'people', but leave the space after 'few'. Replace the space with a comma, using `r`, followed by a comma. At this point, you should have:

```
Love all,  
trust a few,  
do wrong to none
```

...with your cursor on the comma after 'few'. Cursor down to the third line and type `$` - jump to the end of the current line. Press `a` (the letter 'a') – append after the cursor – and type a '.' (period). (Those of you paying attention will realize that this could have been done in one step with capital `A`...but how else was I to stick in the `$` command to jump to the end of a line?) Press escape to go back to normal mode.

Cursor up to the first line and press `J` (capital J). This will *join* this line with the one following. Do it again, and you'll end up with one single line:

```
Love all, trust a few, do wrong to none.
```

And Through The Wire

So, now you have the very basics of editing with `vi`. I mentioned that `vi` begat `vim`, but I didn't yet tell you that `ex` begat `vi`. The foundation of certain commands are *ex commands*. You enter ex command mode, by typing a colon (`:`). You'll see a colon appear on the status line, and the cursor will jump down to immediately follow it. Type `w ws.txt`. 'w' is for 'write', and will write the file 'ws.txt'.

If you need to take a break, you can type `:q` to quit. Re-enter `vi` while loading the file like this: `vi ws.txt`.

We've looked at three ways to get into insert mode so far: `i`, for insert in place, `a` for append at the cursor and `A`, which appends at the end of the current line. Here's one more: `o`. This opens a new line beneath the current line. Try it now.

Don't forget! `vi` inherits all of the integration that using `Terminal.app` brings OS X users. The best is drag-and-drop. While in insert mode, you can pick up a text or .clipping file and drop it on the terminal. The contents will insert at the cursor.



Figure 1: Dragging a .clipping file to `Terminal.app` while editing in `vi`

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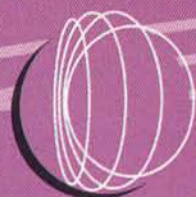
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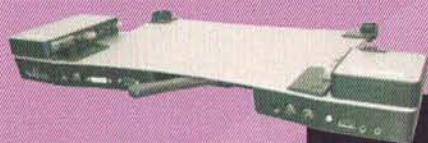
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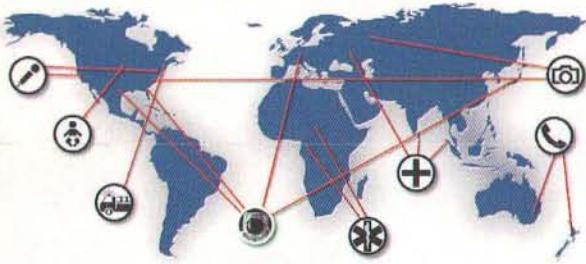
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Try it now, while you're still in insert mode!

At this point, I encourage you to quit vi – :q – and type vimtutor. It's an interactive vi tutorial that takes about 15-20 minutes. Good, basic practice and tips.

More Than This

vimtutor does a good job of covering the basics. Let me wrap up with some of my favorites that neither I or vimtutor have introduced you to.

:shell – this ex command lets you escape to a shell, do your work, and then when you exit, you'll find yourself right where you left off. Now, certainly, this function has lost some value in the days of multi-window machines, but sometimes, it's really handy. It lets you get a lay of the land, and then pick up right from where you left off.

vimtutor shows you how to run an external shell command, but at times, there's even something more useful: running a command and inserting its output at the cursor. To preface this, you can read in a file using the r ex command. You can even read in the file you're working on. Try it now with :r ws.txt. You'll see the contents of the file – as it is on disk – appear inserted into your file after your cursor. Similarly, you can read in the output of a shell command with r !. Insert all of the users from Directory Services into your file with:

```
:r !dscl localhost list /Search/Users
```

This comes in *very* handy. Instead of running a command, redirecting output to a file and then editing that file, you can do it in one step in vi.

vimtutor also shows you how to search using the / normal command. If you didn't run through vimtutor, do it now. Really. Here's two things they didn't get into fully. Load up vimtutor, as it provides ample text for us (quit your current session with :q, and then type vimtutor at the shell prompt). Put the cursor on the first occurrence of the word "commands". You should see several of them. Press * (asterisk). vi automatically starts searching on that word, and jumps to the next occurrence. You can jump between occurrences with n and N. n jumping to the next (forward) occurrence, and N jumping backward.

Anyone familiar with sed will feel right at home with vim's search and replace function. vimtutor showed you searching with /. Search and replace is accomplished with :% s/old/new/g. The "%" represents the entire file. Without it, you're only searching the current line. Additionally the "/g" means *global*, and without that flag, only the first occurrence on each line would be replaced. You can also use the c flag to have vi ask for a confirmation. Go to the top of the file and try this:

```
:% s/commands/friends/gc
```

All occurrences of "commands" will be changed to "friends" and you'll be asked for confirmation of each change. You may notice that this substitution works surprisingly well!

Finally, one option I use quite often: changing line endings. Since a file is just a stream of bytes, the computer needs some way to recognize when humans want to see a new line. Unfortunately, the three major platforms all

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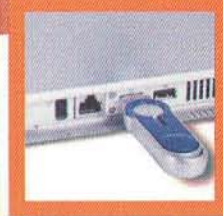
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decided on different ways. Unix and Unix-like systems use a line-feed character (LF), ascii 0x0A. DOS uses both a new line (NL, or carriage return CR) *and* line feed. When DOS sees CRLF, ascii 0x0D 0x0A, it knows to show us humans a new line. Finally, Mac systems traditionally have used a new line only. The current state of line endings under OS X is a bit of a mish-mash. Most GUI apps still use CR, where most (if not all) shell apps use LF.

Many times, you'll receive a DOS line-ending-formatted file that should have Unix line endings. vi handles this with aplomb. Use `:set ff=unix` and then write the file with `:w`. Done! Go the other way with `:set ff=dos`. Sometimes this shows up as ^M (ctrl-M) characters – that's the extra CR character. Just change the file type and write it out.

Don't Give Up

vi is a craftsman's tool. Like any tool, it requires a little work and practice to learn in depth, or to make second nature. I hope next time that you're into a remote system and need to edit a file, or for some reason are forced to use vi, that you'll be confident in your usage. In the spirit of self exploration, take a look at all of the settings that can be changed to tailor vi to your style by trying `:set all`.

Be aware that there is a GUI version of vim available at <http://www.macvim.org>. It may not be a GUI app the way you think of one, but it is integrated with the Aqua environment.

Frankly, though, I never really saw the point in X11 or GUI versions of vi or emacs. In those environments, you'll have access to a shell, so why not use it as intended?

Media of the month: *Up*, by Peter Gabriel. A masterpiece. Seriously. If, for some reason, that doesn't do it for you, just take some time to put on some headphones (real cans, not those iPod things), lay down, and really *listen* to some music.

See everyone next month at MacWorld, I hope! I'm presenting two sessions, and will be hanging around the MacTech booth, so please make sure you stop by and say hello!

References

The vi man page

Vim home: <http://www.vim.org>

Nethack: <http://www.nethack.org>

"All's Well That Ends Well," William Shakespeare

MI

About The Author



Ed Marczak owns and operates Radiotope, a technology consulting practice with a focus on business process enhancement, network and system integration, and, more generally, all things Mac.

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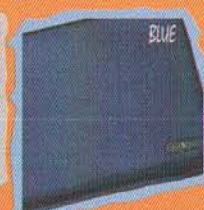


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Xsan, Part 2: Planning Your SAN

By Paul T. Ammann

Introduction

In Xsan Part 1, I introduced you to Apple's Xsan and gave you an overview of SAN technology. Hopefully that article answered the "What is a SAN, and why would I want one?" question.

In this article, we continue the fun by planning your SAN. I'll focus more on the hardware, planning considerations, and planning tasks. There's a lot of ground to cover, so let's get started.

It's easy to add storage to an existing Xsan SAN, but reorganizing a SAN after you set it up is not so simple. So, it's important to plan the layout and organization of your SAN and its storage before you set it up.

An Xsan SAN is composed of:

- Storage devices (usually Xserve RAID systems)
- LUNs (logical unit numbers, usually RAID arrays)
- Storage pools (groups of LUNs)
- Volumes (groups of storage pools visible to users)
- Clients (computers that use volumes)
- Controllers (computers that manage volume metadata)
- Underlying Fibre Channel and Ethernet networks

Before you use Xsan Admin to set up a SAN, decide how you want to organize these components. Take the time to create a drawing or a table that organizes available hardware into RAID arrays, storage pools, volumes, client computers, and controllers in a way that meets both your users' needs and your needs as the SAN administrator.

Then, consider the following questions.

Preliminary Planning Questions

- How much storage do you need?
- How do you want to present available storage to users?
- What storage organization makes the most sense for user workflow?
- What levels of performance do your users require?
- How important is constant availability?
- What are your requirements for security?

Your answers to the above questions will help you decide the following:

- What RAID schemes should you use for your RAID arrays?
- How many SAN volumes do you need?
- How should individual volumes be organized?
- Which LUNs go in each storage pool?
- Which storage pools make up each volume?
- Which clients, users, and groups should have access to each volume?
- Which computers will act as controllers?
- Do you need standby controllers?
- Do you want to use controllers as clients also?
- Where do you want to store file system metadata and journal data?
- What allocation strategy should you use?

Let's review the consideration and guidelines for help in translating your answers into a suitable SAN design.

Planning Considerations

The following sections should help you make some of your SAN design decisions.

How Much Storage?

Because it's easy to add storage to an Xsan SAN, you only need to decide on an adequate starting point. You can then add storage for user data as needed.

You can't expand a storage pool that is used to store volume metadata and journal data. In "Estimating Metadata and Journal Data Storage Needs," we'll examine how to estimate your metadata and journal data storage requirements.

Note that the number of Xserve RAID systems you use affects not only available space but also SAN performance. I'll get to performance considerations in a moment.

How Should Users See Available Storage?

If you want the users working on a particular project to see a volume dedicated to their work, create a separate volume for each project. If it's acceptable for a user to see a folder for his or her work on a volume with other people's folders, you can create a single volume and organize it into project folders.

Workflow Considerations

How much file sharing is required by your users' workflow? If, for example, different users or groups work on the same files, either simultaneously or in sequence, it makes sense to store those files on a single volume to avoid having to maintain or hand off copies. Xsan uses file locking to manage shared access to a single copy of the files.

Performance Considerations

If your SAN supports an application (such as high resolution video capture and playback) that requires the fastest possible sustained data transfers, design your SAN with these performance considerations in mind:



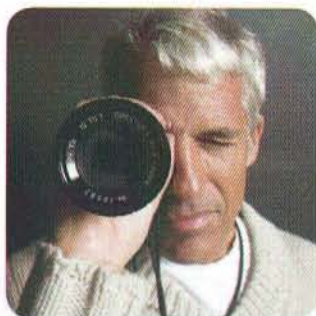
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- Set up the LUNs (RAID arrays) using a RAID scheme that offers high performance. This is covered in "Choosing RAID Schemes for LUNs."
- Group your fastest LUNs in storage pools reserved for the application. Reserve slower devices for a volume dedicated to less demanding or supporting applications.
- To increase parallelism, spread LUNs across different Xserve RAID controllers. For example, instead of creating a single 4-disk LUN on one side of an Xserve RAID, create two 2-disk LUNs, one on each side, and add these LUNs to a storage pool. Xsan then stripes data across the two LUNs and benefits from simultaneous transfers through two controllers.
- To increase parallelism in a relatively small storage pool (the size of one or a few drive modules), create a slice of similar size across all the drives on a controller instead of creating the storage pool from just one or two drive modules.
- Spread file transfers across as many drives and RAID controllers as possible. Try creating slices across the drives in RAID systems, and then combine these slices into a storage pool.
- To increase throughput, connect both ports on client Fibre Channel cards to the fabric and set the multipathing method for the storage pool to Rotate.
- Store file system metadata and journal data on a separate storage pool from user data, and make sure the metadata LUNs are not on the same RAID controller as any user data LUNs.
- Use a router to isolate the Ethernet network used by the SAN from a company intranet or the Internet, or better, use a second Ethernet network (including a second Ethernet card in each SAN computer) for the SAN.
- If your SAN uses directory services, mail services, or other services on a separate server, use a second, separate Ethernet network to connect SAN computers to that server.
- As a rule of thumb, consider that a single Xserve RAID controller, after file system overhead, can transfer roughly 80 MB of user data per second (160 MB per Xserve RAID system). If your SAN must support an application running on multiple clients that requires specific throughput on each client, you can use this number to estimate the number of Xserve RAID systems necessary to support the aggregate transfer rate.

Availability Considerations

If high availability is important for your data, set up at least one standby controller in addition to your primary controller.

Also, consider setting up dual Fibre Channel connections between each client, controller, and storage device using redundant Fibre Channel switches.

Important: Losing a metadata controller without a standby can result in the loss of all data on a volume. A standby controller is recommended.

Also, if you have a standby controller, you can upgrade the Xsan software without interrupting the SAN.

Security Considerations

If your SAN will support projects that need to be completely secure and isolated from each other, you can create separate volumes for each project to eliminate any possibility of the wrong client or user accessing files stored on a volume.

As the SAN administrator, you control which client computers can use a volume. Clients can't browse for or mount SAN volumes on their own. You use Xsan Admin to specify which clients a volume is mounted on.

You can also set up access control lists (ACLs) in Workgroup Manager or assign user and group permissions to folders using standard access permissions in the Finder.

RAID Level	Storage Efficiency	Read Performance	Write Performance	Data Redundancy
RAID 0	Highest	Very High	Highest	No
RAID 1	Low	High	Medium	Yes
RAID 3	High to very high	Medium	Medium	Yes
RAID 5	High to very high	High	High	Yes
RAID 0+1	Low	High	High	Yes

Table 1.

Choosing RAID Schemes for LUNs

Much of the reliability and recoverability of data on a SAN is not provided by Xsan itself but by the RAID arrays you combine to create your storage pools and volumes. Before you set up a SAN, you use the RAID Admin application to prepare LUNs based on specific RAID schemes.

Important: If a LUN belonging to an Xsan volume fails and can't be recovered, all data on the volume is lost. It is strongly

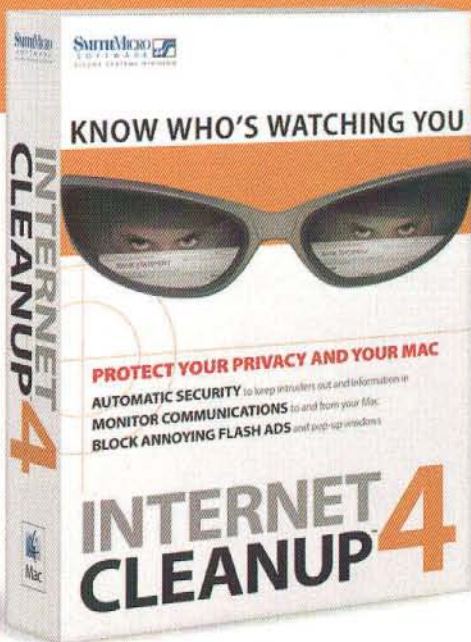
recommended that you use only redundant LUNs (LUNs based on RAID schemes other than RAID 0) to create your Xsan volumes.

LUNs configured as RAID 0 arrays (stripping only) or LUNs based on single drives are difficult or impossible to recover if they fail. Unprotected LUNs such as these should only be used for volumes that contain scratch files or other data that you can afford to lose.

Xserve RAID systems ship already configured as recoverable RAID 5 arrays.

Xserve RAID supports all popular RAID levels. Each RAID scheme offers a different balance of performance, data protection, and storage efficiency, as summarized in Table 1.

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RAID 10, 30, and 50 schemes assume the use of AppleRAID software striping and aren't appropriate for use with Xsan, which performs its own striping.

Deciding on the Number of Volumes

A volume is the largest unit of shared storage on the SAN. If your users need shared access to files, you should store those files on the same volume. This makes it unnecessary for them to pass copies of the files among themselves.

On the other hand, if security is critical, one way to control client access is to create separate volumes and mount only the authorized volume on each client.

For a more typical balance of security and shared access, a flexible compromise is to create a single volume and use folder access privileges or access control lists in Mac OS X Server's Workgroup Manager to control access.

Deciding How to Organize a Volume

You can help users organize data on a volume or restrict users to specific areas of the volume by creating predefined folders. You can control access to these folders by assigning access permissions using Xsan Admin.

You can assign folders to specific storage pools using affinities. You can, for example, create a folder for data that requires fast access and assign that folder to your fastest storage pool.

Assigning LUNs to Storage Pools

You should set up a storage pool using LUNs that have similar capacity and performance characteristics.

To provide high performance, Xsan uses the RAID 0 scheme to stripe data across the LUNs in a storage pool. This requires that the LUNs in the pool be the same size. If you set up a storage pool using LUNs of different sizes, Xsan uses available space on each LUN equal to the capacity of the smallest LUN. If the LUNs vary in size, this can result in wasted capacity. For example, if you assign 240 GB and 360 GB RAID arrays to a storage pool, 120 GB of the larger array will not be used. By combining LUNs with similar capacities, you avoid wasting available storage.

If you want to set up a storage pool for use by a high performance application, assign similarly high speed LUNs. Assign slower LUNs to a storage pool where you keep data that doesn't have critical performance requirements.

Creating storage pools from LUNs that are hosted on different drive modules and different RAID controllers increases performance by increasing the parallelism of data transfers. For example, a storage pool consisting of two LUNs, each a single drive module on the left side of an Xserve RAID, will not be as fast as a similarly sized storage pool made up of two LUNs that are single slices across all seven drives, one slice on each controller. In the first case, all transfers go through a single RAID controller to just two drives; in the second case the same transfer is spread across two RAID controllers and fourteen drives.

Assigning Storage Pools to Volumes

After you decide how to combine available LUNs into storage pools, assign the storage pools to the volumes you want to create.



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For best performance, create a separate storage pool just for file system metadata and journal data.

Deciding Which Clients to Mount a Volume On

If you create multiple volumes, decide which volumes should be mounted on which clients. For example, you might have one volume for Finance, another volume for Executives, and another volume for Executive Assistants.

Choosing Controllers

You must choose at least one computer to be the SAN controller, the computer that is responsible for managing file system metadata.

Note: File system metadata and journal data are stored on the SAN volume, not on the controller itself.

If you have a small number of clients or if performance is not critical you can use a single computer as both controllers and client. You can even set up a SAN consisting of a single storage device and a single computer that acts as both controller and client (to provide network attached storage, for example).

If high availability is important, you should use at least two controllers, one as the primary controller and one as a standby. You can specify additional controllers as needed, and set their failover priorities to determine the order in which they are tried if the primary controller stops responding. *[Ed. Note - More than for simple high availability, a redundant metadata controller is critical for many reasons, data protection not being the least. Don't even contemplate setting up XSan without two dedicated metadata controllers.]*

If performance is critical, don't run other server services on the metadata controller and don't use the controller itself to reshare a SAN volume using AFP or NFS.

Choosing Standby Controllers

To be sure that SAN volumes are always available, set up at least one standby controller that can take over if your primary metadata controller fails. A standby controller also makes it possible for you to upgrade software on the controllers without interrupting user access to SAN volumes.

Combining Clients and Controllers

The same computer can function as both a metadata controller and a client. It's possible, for example, to set up a SAN consisting of a single Xserve RAID and one computer that acts as both controller and client. Any computer you specify as a controller can also act as a client.

If, for example, you don't have a computer to dedicate as a standby controller, you can assign a



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computer that is normally used as a client to take over controller duties if the primary controller fails.

To keep clients and controllers separate, you can set up client-only computers for your users.

Choosing Where to Store Metadata and Journal Data

The metadata and journal data that describe a volume are not stored on the volume's metadata controller but on the volume itself. By default, they are stored on the first storage pool in the volume. If the volume consists of more than one storage pool, you can choose which storage pool is used to store metadata and journal data.

In most cases, storing metadata and journal data on the same storage pool as user data results in adequate performance. However, for the best possible performance, store metadata and journal data on a separate storage pool within the volume and make sure that the LUNs used are connected to a different RAID controller than the LUNs that make up user data storage pools.

Estimating Metadata and Journal Data Storage Needs

To estimate the amount of space required for Xsan volume metadata, assume that 10 million files on a volume require approximately 10 gigabytes of metadata on the volume's metadata storage pool.

Choosing an Allocation Strategy

The allocation strategy you choose for a volume determines the order in which its storage pools are filled with data. You can choose round robin, fill, or balance.

If you choose round robin, Xsan writes new data in turn to each storage pool in the volume.

If you choose fill, Xsan writes all new data to the first storage pool in the volume until that storage pool is full, and then moves to the next storage pool. This is a good choice if you want to keep a particular storage pool unused as long as possible.

If you choose balance, Xsan writes new data to the storage pool with the most free space.

Summary

In closing this article, I hope I have covered enough topics to assist you in your planning considerations for a SAN. SANs have many benefits, but careful planning is needed before setting one up.

MT

About The Author

Paul T. Ammann has been working in IT for almost 20 years now. He is happily married to his wife Eve for 7 years. He finds writing the author's bio the toughest part of the article. He can be contacted at <pammann@spymac.com>.

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Sorting

By Paul T. Ammann

Every so often, I try to write articles that contain practical help. The notion to write this column came, when I was processing data from one of the logs created by my Web server. The referrer log tells me the last port of call made by a visiting surfer; it records the page that a visitor was reading when they clicked a hyperlink to access one of my pages or images. I can find out who has links to my pages, and how often those links are exercised. The log has one line per record and three fields per line: the source URL, an arrow (in the form of `->`), and the destination page or image. Each field is separated by white space, and so can easily be processed with standard UNIX tools.

There are several questions that I like to ask about this data. What pages are most frequently used to link to my pages? Which pages are most frequently accessed from outside? Are there any surprise entry points that people have linked to? Is anyone linking directly to an image? I do think that it's bad manners to incorporate other people's images in your pages, unless you inform and ask the originator. On the whole, I don't mind people using my images, as long as, proper credit is given, and others are not passing off my work as their own.

Using awk

I haven't created any specific shell scripts to process the referrer log data. I usually type the lines that I need into the shell to obtain the result I am looking for. The questions above mean that I will be processing one or other of the space-separated data columns from the file, and I need some way of selecting the appropriate data. The tool that I always use to select one column from a file is **awk**. For example, the command

```
$ awk '{print $3}' log
```

will print column three of the source file log on the standard output of the command. This column holds the target page addresses in the referrer log. The **awk** program in braces is quoted with single quotes so that the dollar character is not expanded by the shell. Using quotes is a good habit to get into, for **awk** or **sed** programs typed on the command line.

I find that I use the column selection facilities of **awk** more frequently than any of its other commands. The column select format is easy to remember, and is useful in many circumstances. For example,

```
$ awk '{print $3,$1}' log
```

can be used to filter the arrow out of the referrer log and also swaps columns.

The general form of an **awk** command is:

```
selector {commands}
```

The selector is applied to all the lines that are read from the input data file, and if the selection succeeds, then the commands within the braces are executed. In the above examples, the selector is empty so the single command is applied to all the lines from the source file log.

Actually, because the **awk** command is processing a log file, it's a good idea to be suspicious of the data. Sometimes log files are not written properly, or the data is written onto them is not what you expect. In this case, being suspicious paid off. It turns out that some of the URLs written in column one of the log contained embedded spaces, meaning that rather than having three columns on the file, there are sometimes more. I used a small one-liner to determine this:

```
$ awk 'NF != 3 {print $0}' log
```

The command makes use of the selector field. The selector here is a Boolean expression, testing the inbuilt **awk** variable **NF** that holds the number of fields that **awk** has found in the input line. If the number of fields is not equal to three, then I print the whole line (**\$0**). I then look at the output to see what the exceptions are, and quickly see the embedded spaces in the five or so lines that are output.

However, because the extra spaces are only in column one of the log, I can use an alternative procedure to obtain the last column. The easiest way to pick off the last column in a file is to use

```
$ awk '{print $NF}' log
```

Because the **NF** variable is set to the number of fields on the input line, **\$NF** will pick off the last column on each line. However, things are a little trickier if I want to accurately pick off the first column in the file. The command

```
$ awk '{print $1}' log
```

won't work properly because the data that should be in column one is sometimes spread into two or more columns. It's possible to make **awk** do the right thing by sticking the columns together using a sequence of commands that feed data into the **awk** command.

However, life is too short and the answers to the questions that I posed above are not materially affected by the slight inaccuracies caused by occasional failure to pick up the complete URL from each line. So my judgment in this case is that using the **\$1** select to pick off the first column is good enough.

The uniq Command

Well, having selected the data, what next? I can look at the raw data, but that's tedious. It's better to process it somehow to reduce the amount of information that I need

to look through. One obvious way of looking at data with replicated entries is to generate output that omits duplicates. The `uniq` command can do this.

The `uniq` command is designed to output exactly one instance of any lines that are repeated in its input stream, so simply using the `raw` command as a filter will ensure that we only see each data item once. However, I prefer to see output that contains the data, and the number of times that a particular data item is repeated. When `uniq` is supplied with the `-c` switch, it will print a count of each repeated line along with the data. So, if we have a data stream like

```
one
two
two
three
three
three
```

then `uniq -c` will print

```
1 one
2 two
3 three
```

counting the frequency that each repeated line occurs. However, to use this counting ability on raw data, we first need to sort the data, so that all identical lines are next to each other. We'll type

```
$ awk '{print $NF}' | sort | uniq -c
```

and will see the frequency counts and the data being output. The output from this command is still not as helpful as it might be, so as a final touch, I will usually pass the data into the `sort` command again. This time I will tell the command to sort numerically on the first field, the count, by supplying the `-n` switch. So, when typing the line above, I'll usually append

```
... | sort -n
```

or

```
... | sort -nr
```

depending on how I want the output to be sorted. The first variant of the command will sort into ascending numerical order, so the items with the most access frequency will be printed last. I usually prefer the data to be sorted into descending frequency order, and use the `r` option to the `sort` command to reverse the order of the sort. It's often true to say that the data of most interest is at the start and the end of the frequency spectrum.

So, processing column three of the referrer log to generate a frequency list will answer some of my original questions, the queries about the targets of other people's links. I can also use `grep` to find out about direct links to images from this output, and identify the source of the direct links to images by looking through the original data.

To answer the other questions about the source of links, I'll need to look at column one of the log, the

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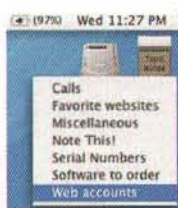
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source URL. When looking at column one of the data, it helps to know a little about URL construction. If the visitor came to my pages from a search engine, then the arguments to the search are contained at the end of the URL, after a question mark. This can be helpful. I can deduce what people were looking for in the search engines, when they ended up at my pages.

However, if I am examining the first column to deduce the most frequently used links to my pages, I am not interested in the search information, I just want to see the base URL. The trick is to massage the data from the log file before it's passed into `sort`, `uniq`, and `sort -n`. Simply deleting any data after a question mark will ensure that only the URL is left from the source data, so I'll type something like:

```
$ awk '{print $1}' log | sed -e 's/?.*$//' |  
sort | uniq -c | sort -nr
```

Here, the argument to `sed` deletes all data on any input line that starts at a question mark, and extends to the end of the line. Using this preprocess technique to suppress or alter the data, there are various other refinements that I can make to give me the answers to other questions that I may ask.

Using `uniq -c` and `sort` to obtain frequency counts of data is applicable in many situations. It's a common method to reduce information to a form that allows you to appreciate the raw data in a more meaningful way. For example, the `du` command generates columns of data: a number relating to the disk occupancy of the directory and the name of the directory. You can sort this output using `sort -n`, to give yourself a feel for what is happening on the file system.

However, beware that the `du` command prints sizes in kilobytes. The trick here is to use the `-k` switch to `du`.

More on sort

If you look at the manual page on your system, you'll find that the `sort` command has several useful switches that can help you look at data in different ways. For example, the `-f` option treats lower- and uppercase letters the same for sorting, and can be helpful if you want to look at a directory using `ls`, placing files of similar names next to each other.

```
$ ls | sort -f
```

This command will revert to the original form of `ls`, giving you one file name per line. If you want a columnar listing, then pass the output from the above command through `pr`, supplying the `-t` option to suppress headers:

```
... | pr -t -6
```

The `-6` will give you six columns. My shell has an environment variable called `COLUMNS` that is set to the number of columns in the current windows, so

```
... | pr -t -8 -w $COLUMNS
```

will print eight columns across the width of the screen. You do not need to be careful of the output from `pr`; it will truncate data that doesn't fit into its pre-computed column space, so filenames can appear shorter than they are.

Of course, it's harder to sort the output of an `ls -l` command into case-independent name order, because the



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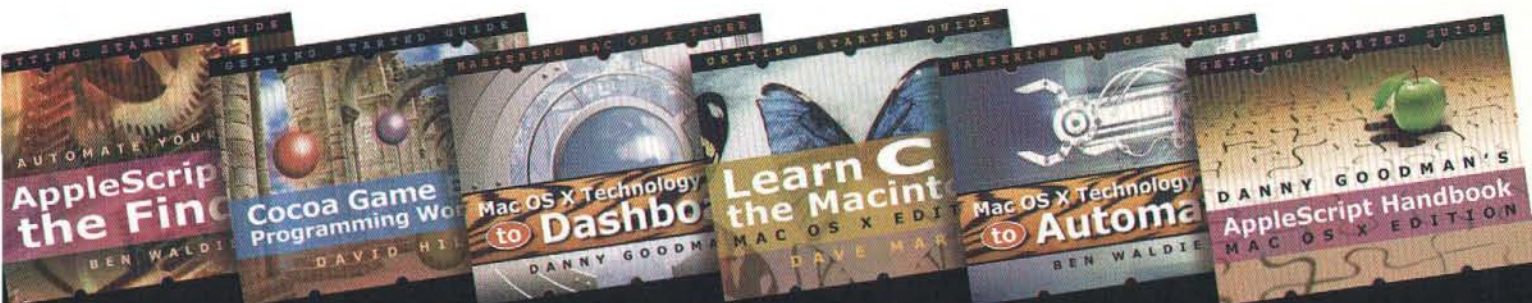


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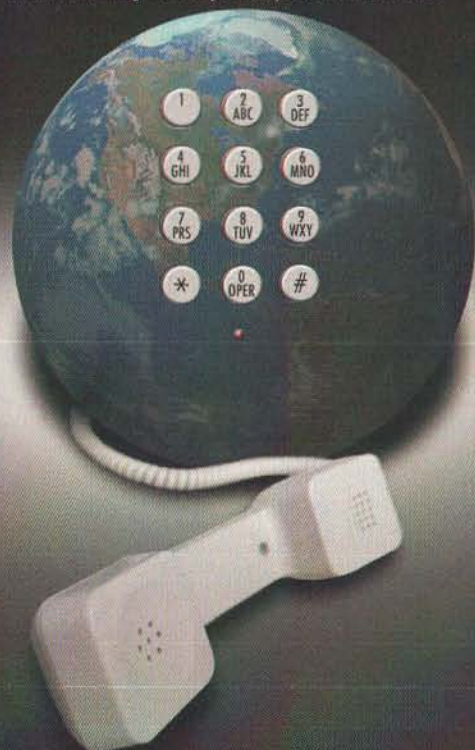
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output lines have all the other file information, such as file permissions, owner identity, size, and so on. By default, if you just sling the data from `ls -l` command into the `sort` program, then the whole line will be used as a key, and the output will probably not be what you want. You need to tell the `sort` command to use some part of the input line as the sorting key.

If you look at the output from `ls -l`, you will see that there are nine white-space-separated fields. The file name is the ninth field, and if you wanted to sort the output into case-independent order using the old arguments to sort, you would say

```
$ ls -l | sort -f +8 -9
```

You could read this as "use a sort key starting *after* the eighth field and stopping at the end of the ninth field," i.e., use the ninth field as the primary sort key. Alternatively, you could start counting the fields from zero, and arrive at number eight for the value, for the name field. You can choose how to think about the arguments; the effect is the same.

Had we not given a stopping point for the field, then sort would use a sorting key commencing from the starting point, and terminating at the end of the line. In the example above, the stopping position is not necessary, but I've included it for completeness.

You can use the `sort` argument `-k` followed by a comma-separated range. Also, it starts numbering the fields from one, so

```
$ ls -l | sort -f -k 9,9
```

will start the field at the beginning of the ninth field, and finish it at the end of the ninth field. This seems a little more intuitive.

The question then arises about what happens when the fields are identical. This can happen naturally in other data sets and can still be relevant when looking at file names that are guaranteed to be unique. For example, `Fred` is a different file from `fred`, but sort will treat the two names as the same, when we are using the `-f` option. If you have selected a field and `sort` finds that the fields in two lines are the same, then the default follow-up action is to use the whole line as a sort key to order the two lines.

There are obviously situations where different follow-up actions are needed, and `sort` supplies some further options. The first option is to supply the `-u` argument, suppressing records with identical fields, which allows the `sort` command to take on some of the functionality of the `uniq` command.

If you want to see the replicated data, then the second option is to apply the sort modifier just to the field, by putting the magic control letter after the field specification, rather than making it apply to all fields by placing it before the `-k` on the command line. We can then provide several different sort criteria for different fields and add multiple field selections:

```
$ ls -l | sort -k 9,9f -k 6,6M
```


Here, we will sort files into case-independent order based on field nine. Then, if the names are the same, we will sort based on field six using month name comparison. The **M** modifier sorts the field by recognizing a three-character month name and sorting into month order. Of course, we can go on adding fields to make a better job of sorting on the date in the **ls** output. Incidentally, the **M** modifier is not standard POSIX.

Field Separators

Field separators have always been a problem for **sort**, and they don't seem to have been completely rationalized by POSIX. POSIX says that in the default case, field separators are treated as part of the sort key. Therefore, spaces and tab characters that will appear to be the same white space on the screen, will mysteriously sort into what appears to be a strange order. The folks who wrote the *UNIX Power Tools* book (see Further Reading), came to the conclusion that in the default case you always had one "free" blank character that was not included as part of the field. I suspect that you need to experiment with your implementation to find out what happens, if the separator behavior seems to be causing problems. One possible light at the end of the separator tunnel is the **-b** option, which tells the **sort** command to fold multiple occurrences of the separator character into one. The general advice in difficult cases where tabs and spaces are used for separators is to replace all the tabs with spaces and use

```
$ sort -t ' ' -b ...
```

to ensure that separators are collapsed to a single character that is not regarded as part of any sorting field.

If you need to specify byte insets into sorting fields, then this is possible with a further piece of syntax. An offset into a field is given by supplying a number after a period in the key definition field, so

```
$ sort -k 2.3b,2.3b
```

will sort the data based on the third non-blank character of the second field. I do suspect that I am now entering realms of the **sort** command that are rarely used, largely because people don't know that the ability to do the job is available, and also because it seems hard to prove that the sorting you need is actually being done by the program.

Further Reading

As I have mentioned, there's a whole section on sorting in *UNIX Power Tools* by Jerry Peek, Tim O'Reilly, and Mike Loukides et al. It's published by O'Reilly & Associates (ISBN 0-553-35402-7).

MI

About The Author

Paul T. Ammann has been working in IT for almost 20 years now. He is happily married to his wife Eve for 7 years. He finds writing the author's bio the toughest part of the article. He can be contacted at <pammann@spymac.com>.



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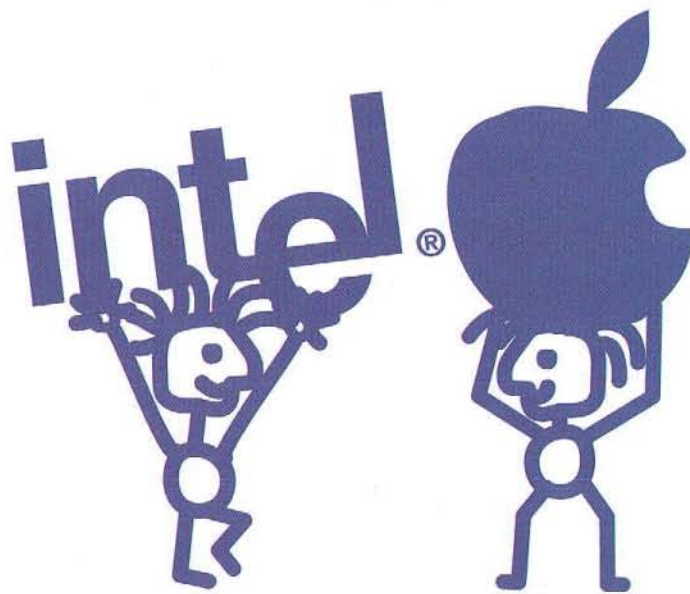
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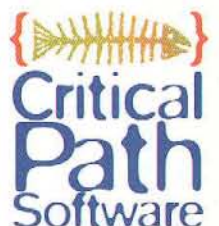
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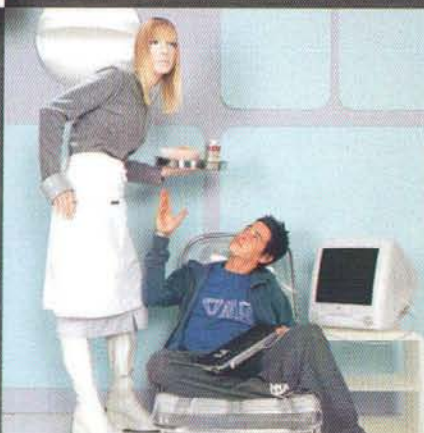


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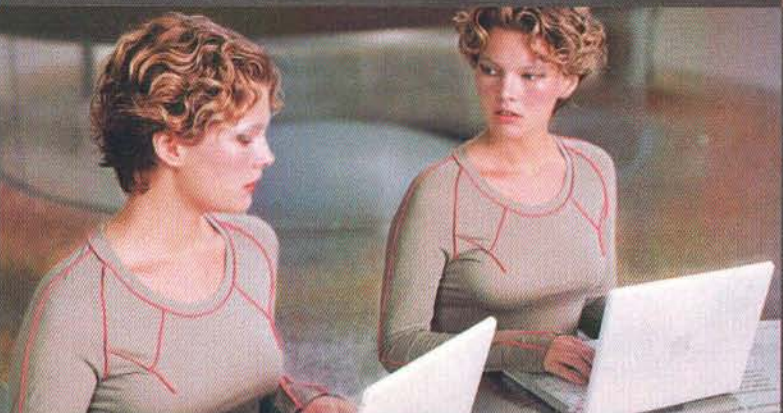


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Main web site: www.sanyo.com
See advertisement on page 49 of this issue.

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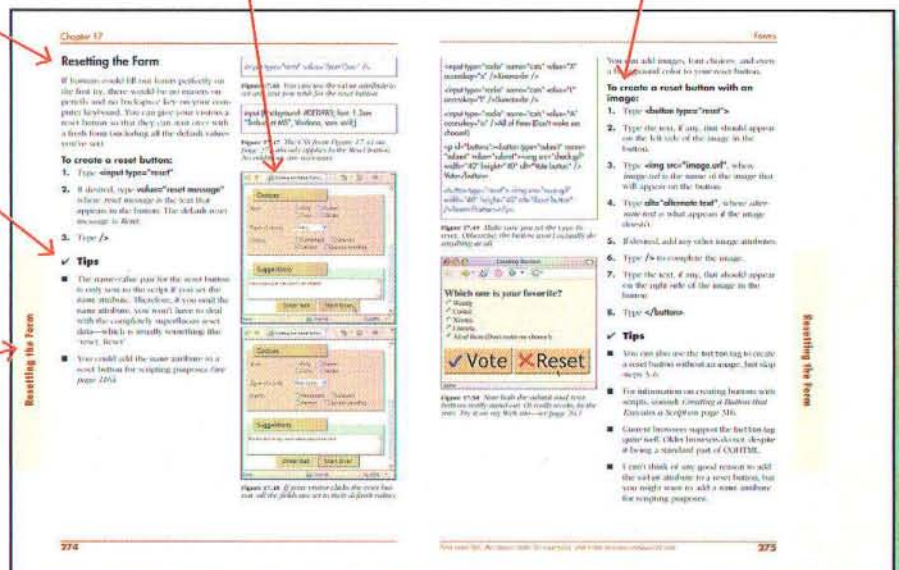
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Main web site: www.subrosasoft.com

SubRosaSoft specialized in privacy related and system utilities. SubRosaSoft's design philosophy revolves around easy-to-use yet extremely powerful software. Our software range includes security, file and device management, home security, forensics, and data and device recovery. Our users range from entry-level Mac users and hobbyists to system administrators, consultants, and forensics professionals.

See advertisement on page 1 of this issue.

Trango Broadband Wireless

9939 Via Pasar
San Diego, CA 92126
Sales: 858-653-3900

Main web site: www.trangobroadband.com

Trango is the only end-to-end manufacturer 100% dedicated to fixed broadband wireless products in the world—products used in over 70 countries to wirelessly connect consumers, businesses and government agencies needing high-speed data transmission for internet access, private networks or surveillance applications.

See advertisement on page 83 of this issue.

Tropical Software, Inc.

246 Myra Street
Neptune Beach, FL 32266
Sales: 888-876-7424
Phone2: 904-249-4292

Main web site: <http://www.tropic4.com>

TopXNotes is a note pad replacement with multiple views, instant access to key information, iPod integration and more.

See advertisement on page 65 of this issue.

Underwriters Technologies

4255 E Charleston Blvd.
Las Vegas, NV 89104-6640
Sales: (877) 523-7150
Main web site: www.uwtech.com

Out of the box, Mac minis are very capable and very easy to use. They are able to serve mail, websites, databases, files, etc. We provide a high speed, high security location to host your Mac mini at a low price point.

See advertisement on page 14 of this issue.

Utilities4Less.com

1652 Cross Bridge Place
Thousand Oaks, CA 91362
Sales: (800) 906-8686
Main web site: www.utilities4less.com

Utilities4Less offers its clients a full range of communications services. Utilities4Less is committed to offering the best products available at the lowest possible prices.

See advertisement on page 68 of this issue.

VersionTracker

55 SW Yamhill St.
Portland, OR 97204
Main web site: www.techtracker.com

VersionTracker Pro gives subscribers a powerful tool to update and inventory all their applications and drivers automatically, helping them keep their software current and secure. VersionTracker Pro provides customized information by creating machine-specific tracking lists, accessible through a Web browser or automatically distributed directly to the user's desktop.

See advertisement on page 62 of this issue.

WIBU-SYSTEMS AG

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Karlsruhe, D-76137
Germany
Sales: +49-721-93172-0
Main web site: www.wibu.de
WIBU specializes in developing software protection and additional solutions to

protect documents, access and media. The permanent increasing customer base is enthusiastic about the versatile products. WIBU-KEY, CodeMeter, SmartShelter and SecuriKey.

See advertisement on page 53 of this issue.

Windows IT Pro

A Division of Penton Media Inc.
221 E. 29th St.

Loveland, CO 80538

Sales: (800) 621-1544

Main web site: www.windowsitpro.com

The Windows IT Pro magazine network—which includes Windows IT Pro magazine, SQL Server Magazine, Exchange Administrator, Windows IT Security, and Windows Scripting Solutions—is the leading independent, impartial source of practical, technical information to help IT professionals better understand and manage the Windows and SQL Server enterprise.

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WorldSync, Inc.

2039 Shattuck Avenue, Suite 302
Berkeley, CA 94704
Sales: 1-877-548-4920

Main web site: www.syncdek.com

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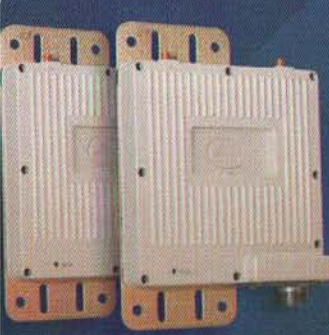
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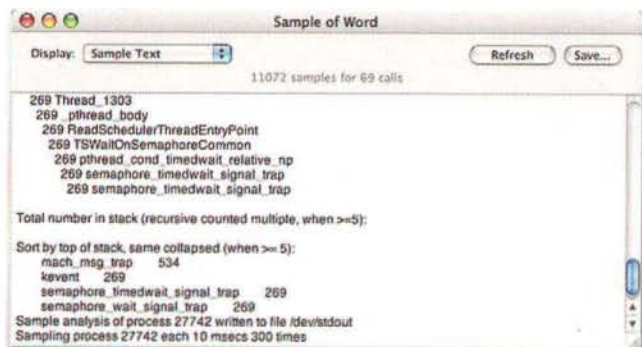
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